OCTOBER, 1940

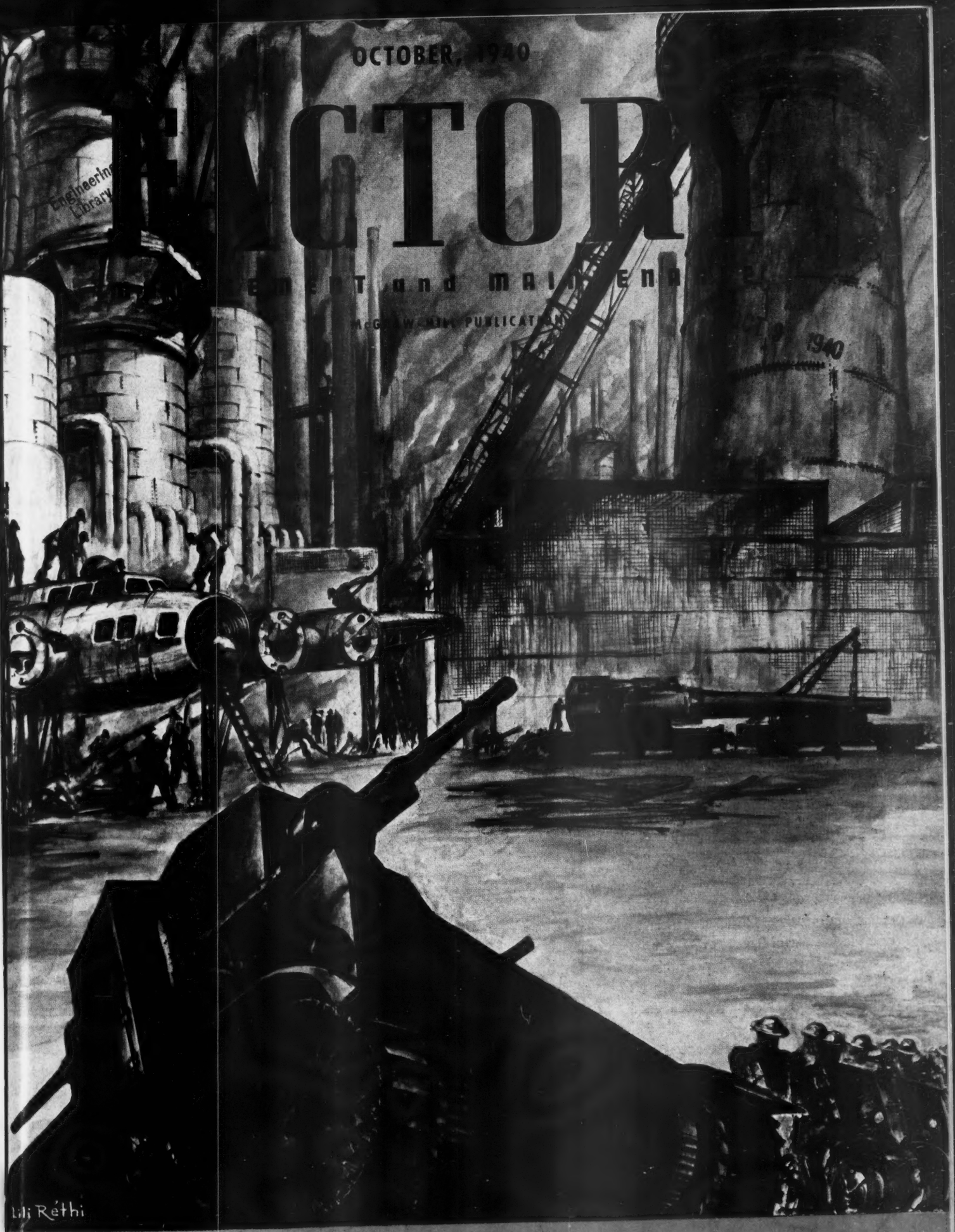
FACTORY

...ment and Maintena...

McGRAW-HILL PUBLICATION

Engineering Library

1940

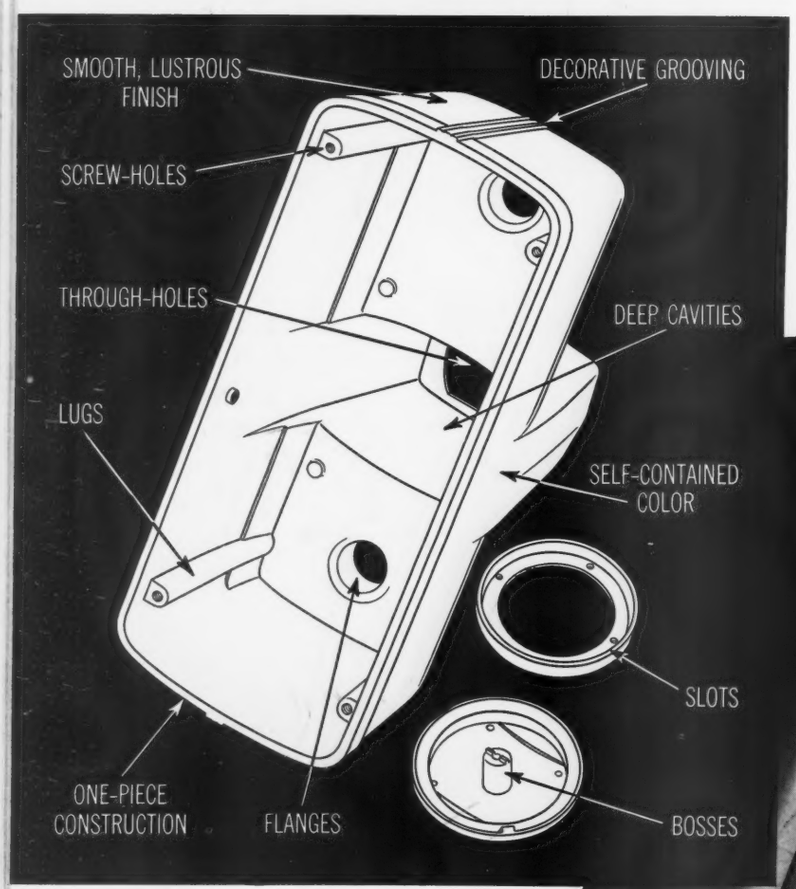


Lili Réthi

THE TRUTH ABOUT DEFENSE — Page 42

Numerous Production Economies Obtained with Bakelite Plastics

IN THIS LARGE CANDY SCALE HOUSING

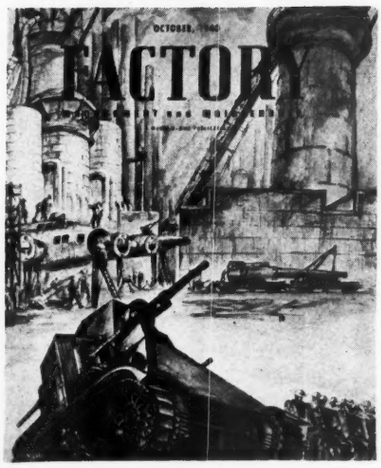


REQUIRING only one molding operation to complete the single-piece case and one more for the two smaller sections, this large Beacon Candy Scale Housing is rapidly and economically fabricated entirely from Bakelite Plastics. Machining operations are avoided, for every contour is accurately reproduced in the molding process. Costly surface finishing also is eliminated because lustrous, self-contained color is inherent with Bakelite Plastics. Learn how you can apply these time-and-money-saving features to *your* products by writing for illustrated booklet 12P, "New Paths to Profits".

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 EAST 42ND STREET, NEW YORK

BAKELITE
TRADE MARKS
The word "Bakelite" and the identifying products Symbol are registered trade-marks of Bakelite Corporation

PLASTICS HEADQUARTERS



The success of America's defense effort depends, not on the billions of dollars her Congressmen appropriate, but on the number of ships and planes and tanks and guns her industries can produce—and the speed with which they produce them. It is that conception of American industry in back of the tanks and planes needed for defense that this month's full-cover picture catches. It was drawn by Lili Réthi, being the third of her FACTORY covers.

•

A. M. STAEHLE, *PUBLISHER*
L. C. MORROW, *EDITOR*

G. A. VAN BRUNT, LEWIS K. URQUHART
Associate Editors

J. F. ANDREWS, CHARLES B. COATES
Assistant Editors

A. H. MOGENSEN, ARTHUR VAN VLISSINGEN, WHITING WILLIAMS
Consulting Editors

H. P. DUTTON, *Chicago* C. B. GORDY, *Detroit* PAUL WOOTON, *Washington*

H. E. HILTY, *Sales Manager*

Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including *"Factory"*) and *Maintenance Engineering*. Price 35c a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y.

Subscription rates — United States, Canada, Mexico, and Central and South American Countries, $3 for one year, $4 for two years, $5 for three years. Great Britain and British Possessions, 24 shillings for one year, 48 shillings for three years. All other countries, $4 for one year, $8 for three years. Cable address, "McGrawhill, New York." Member A.B.P. Member A.B.C. Copyright 1940 by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance, September, 1940, Vol. 98; No. 9. Published monthly, McGraw-Hill Publishing Co., Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post Office, Albany, N. Y., U. S. A., under the act of March 3, 1879. Branch offices: 520 North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

McGRAW-HILL PUBLISHING CO., INC.

JAMES H. MCGRAW
Founder and Honorary Chairman

JAMES H. MCGRAW, JR., *President* HOWARD EHRLICH, *Executive Vice-President*

MASON BRITTON, *Vice-Chairman* B. R. PUTNAM, *Treasurer*

D. C. MCGRAW, *Secretary* J. E. BLACKBURN, JR., *Director of Circulation*

A McGRAW-HILL PUBLICATION

FACTORY

MANAGEMENT and MAINTENANCE

OCTOBER, 1940

Keep Industry Out of the Doghouse.....*L. C. Morrow* 41
The Truth About Defense..... 42
Must Model Changes Mean Parts Losses?.....*R. F. Hurst* 53
Pete Gets New Slant on New Methods.....*James Curtin* 55
"This Is No Time for Politics".....*Whiting Williams* 56
Cases in Work Simplification.....*James J. Baer* 58
Each Order Dictates Its Own Layout....*Frank E. Graper* 60
Films Teach Foremen Tact..... 62
Enameling in Nine Minutes with Infra-Red Lamps *W. A. Howe* 64
One Form for Personnel Records.....*J. E. Walters* 66
Management Shorts 68
Light Is Cheap Protection Against Trespassers... Fire Prevention Week Means Just That... Give Paint a Chance To Do Its Best.....editorials 72
Motor Troubles I Have Met.....*Lionel A. Hunt* 73
Stop Vibration, Add to Lamp Life.....*James D. Hall* 75
Instruments Pay Us a Good Profit...*Charles E. Armstrong* 78
Into Every Ear, by Loudspeaker..... 80
New Drives, 15% More Production.....*Robert Whitney* 82
Maintenance Forms 84
Centralized Lubrication Is Safe and Speedy..... 86
Maintenance Service Shorts..... 88
Data Sheets: Electrical Control Troubles and Their Causes. 94
You Want to Know..... 98
What's New in Equipment..... 106
Books 148
Calendar 152
They Say and Do..... 158
Catalog Service 170

Wood's

LONG LIFE LINE

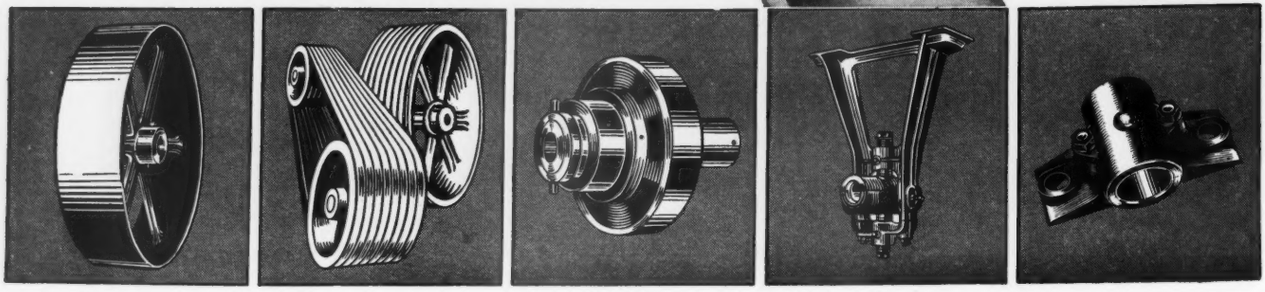
Just as the steeplejack painter depends on the line for his life—so can you depend on Wood's line of Power Transmission Equipment for a long life of trouble-free, more efficient service.

Measured both by inherent quality and actual performance, Wood's products represent the better buy in the field. And because of the knowledge gained in more than eighty years of practical experience, your plant can be operated more economically—your product can be made more profitably. Write today! There's no obligation.

T. B. WOOD'S SONS COMPANY
Chambersburg, Pa.

EVERYTHING IN TRANSMISSION

Bearings — Collars — Clutches — Couplings — Contactors — Hangers
Pillow Blocks — Pulleys — V-Belt Sheaves and Complete Drives



FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Keep Industry Out of the Doghouse

FOR THE GOOD OF THE NATION it is imperative that industry keep out of the defense doghouse. If industry should fall into public disfavor, so many things could happen in so short a time that the nation might be preparing to defend something already lost. After all, industry *is* defense.

There has been much loose talk, most of it unfair, about industry's insistence upon being assured a big profit before it will go to work on defense. Bills under discussion by Congress have seemed to consider industry as suspect. True, both amortization and excess profits provisions are necessary, and it is a function of Congress to make them. Nevertheless, the impression has been given, by the prolonged discussion of these two items—and by the conscription-of-industry clause in the Selective Service Act as well—that industry is a bad boy and will misbehave if he can.

Obviously, industry has a job to do. Part of that job should consist of refuting erroneous and untruthful statements. But a more important part is beating the calumniators—both willful and unwitting—to the punch. The job will be done effectively only when the public is kept so well informed, in advance of accusations, that those accusations will not be believed.

There is no magic formula for doing the job. In fact, there is only the formula that has not been too well followed by industry in the past. It is the formula of public relations.

Every reader of FACTORY will remember how it runs: Conduct all internal affairs fairly and efficiently and tell the employees how you are doing so. Make and take opportunities to give the community the facts about your part of industry.

It is reassuring to an employee to know that his company is doing everything it can to contribute its share to national defense. It is more than reassuring—it is a matter of which he is proud, and about which he will talk. Employees like to be proud of their companies; they like to know that through their companies' activities they themselves are holding up their share of the national teamwork.

Communities, too, like to strut a bit about what they are contributing to a great cause. There is no question that a town or city hates to be known as the community that is out of line—as the seat of greatest unemployment, for example, or of least contribution to protection in a period of national danger. The converse is true; it is proud of itself when, through its industries, it is contributing its full quota to the national obligation.

If my interpretation of events and comments is correct, industry is not as close to the doghouse as it was two or three weeks ago. More people are learning that defense equipment cannot be built overnight; that industry's stand against hysterical and unreasonable expansion is a stand to maintain plants and jobs for the future as well as the present; that defense work must be done right, financially as well as technically. Public relations work can move industry farther and farther from the doghouse.

It gives no satisfaction to advise an already harassed management to take on an additional burden. Yet it must be done, because of the need to get industry's defense work accomplished under conditions of public respect and confidence.

L. C. Morrow

The Truth About Defense

We're miles ahead of 1916-17, miles behind the armed nations of Europe. Few citizens—and few Congressmen—realize that it will take years to build a war machine. America has lost months while Congress wrangled over conscription, amortization, excess profits. And the Defense Commission still lacks one-man leadership

"WHAT ARE WE GETTING for our defense money?" The American people are already asking that question. The traditional "milkman in Omaha" has been reading the billion-dollar headlines in the newspapers. He expects miracles of industry. If he doesn't see thousands of tanks, planes, and guns rolling from the assembly lines in very short order, he is going to become impatient.

The fact is that mass production of munitions will not, *cannot* get underway on a broad front for at least a year. This would be true if industry had been given the most favorable conditions possible from the start. Instead, industry's path has been blocked by needless legislative delays.

Yet the blame, when the delay becomes fully apparent, may be laid at industry's door. Even now industry is charged with refusing to cooperate without the assurance of "big profits."

The milkman in Omaha is all too ready to accept this explanation. It is so much simpler than the facts.

Seven Conclusions

Seeking the facts, FACTORY has reviewed the progress of our national defense program in consultation with well-informed sources at the center of action, both in government and in industry. These conclusions stand out:

1. We are miles ahead of 1916–17 in many ways—miles behind in others.

2. We have not even begun a real defense effort as such things are understood in Europe.

3. We have made decided progress but we have lost most of three precious months during which Congress wrangled and harangued over tax laws that it should have passed promptly to make industry free to produce war materiel.

4. The real bottleneck has thus been centered not in the Army, not in the Navy, not in industry, but in a certain faction in Congress itself. The delay is the fault of some of the very men who blame it on industry.

5. The whole defense job cries aloud for strong central leadership. The elements of a smooth, effective program are right there in Washington, waiting for one man with the ability and authority to pull them together.

6. The very existence of the National Defense Advisory Commission is perhaps the most encouraging feature of all. But the Commission is just what its name suggests, an advisory board, and nothing more. This should be remembered lest later the commission be blamed for failing to accomplish tasks to which it was never assigned.

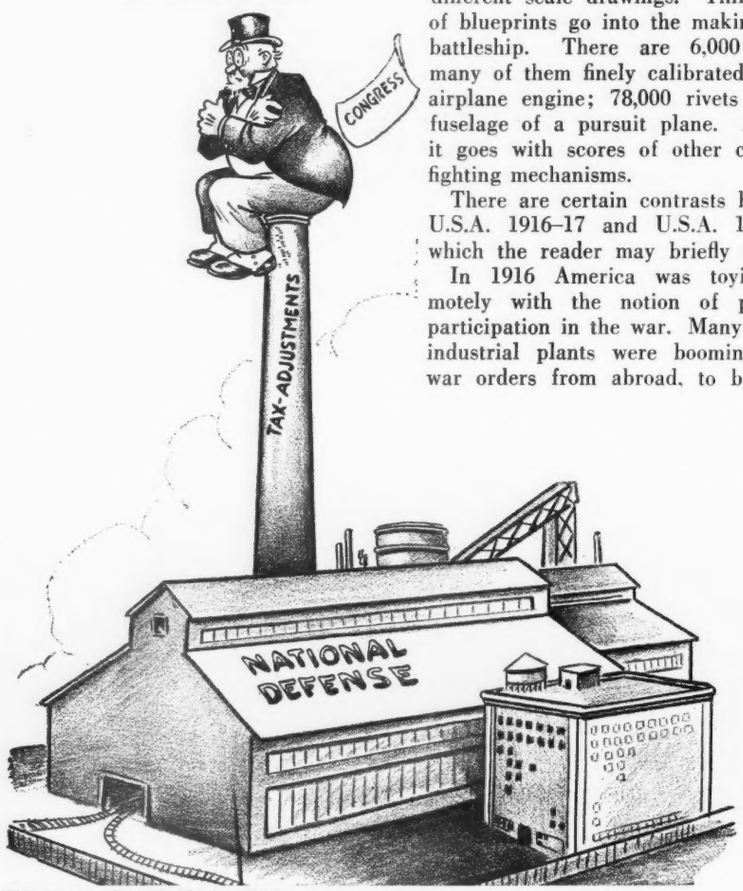
7. The public and most Congressmen simply do not understand the time element in industrial production of munitions. They must be told again and again until they *do* understand why it takes time to build tanks, guns, and planes. They must realize that wars are won in factories years before the conflict in the field.

To build a light tank requires 2,500 different scale drawings. Thirty tons of blueprints go into the making of a battleship. There are 6,000 parts, many of them finely calibrated, in an airplane engine; 78,000 rivets in the fuselage of a pursuit plane. And so it goes with scores of other complex fighting mechanisms.

There are certain contrasts between U.S.A. 1916–17 and U.S.A. 1940 in which the reader may briefly rejoice.

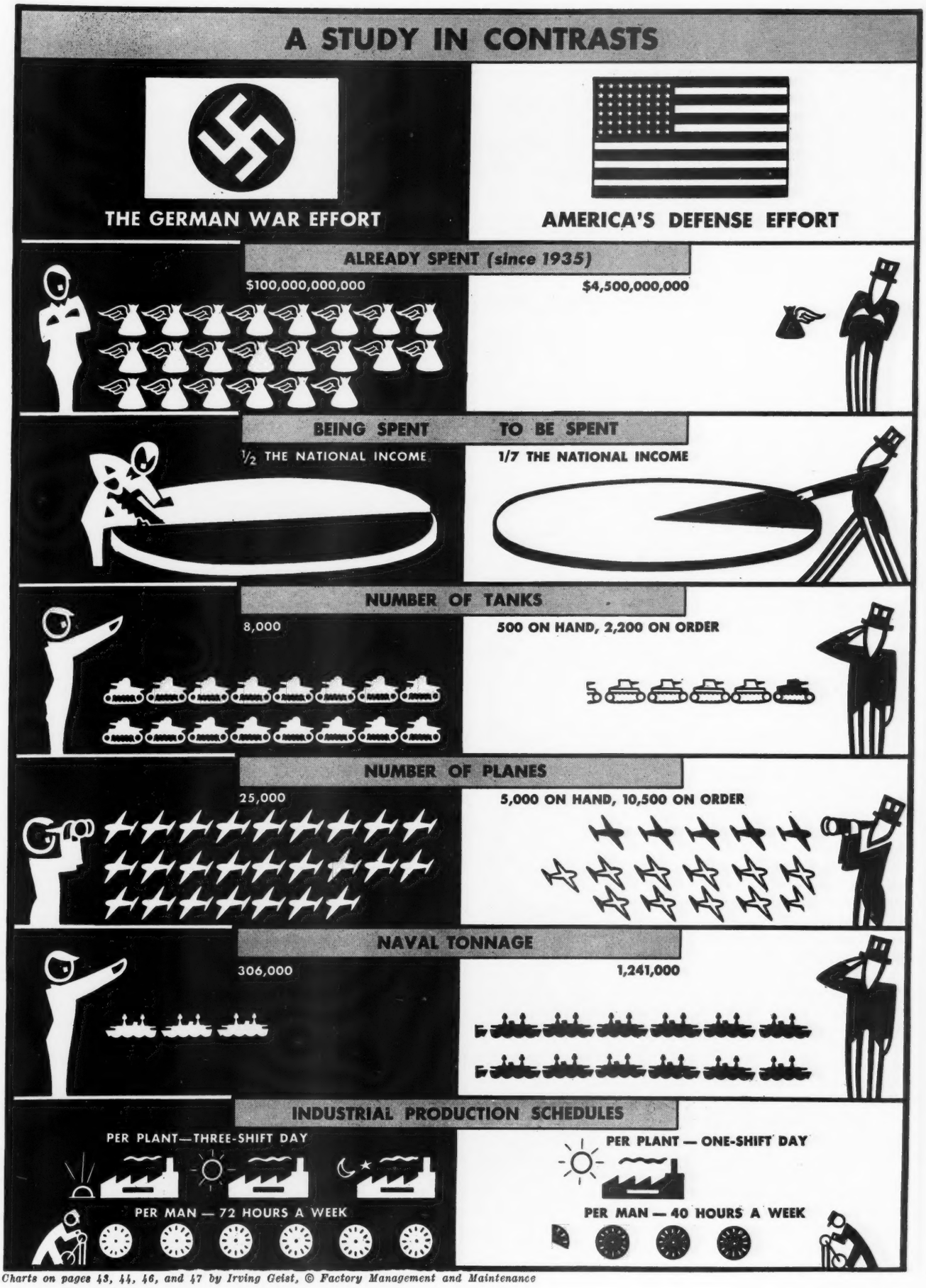
In 1916 America was toying remotely with the notion of possible participation in the war. Many of our industrial plants were booming with war orders from abroad, to be sure,

PREPAREDNESS?

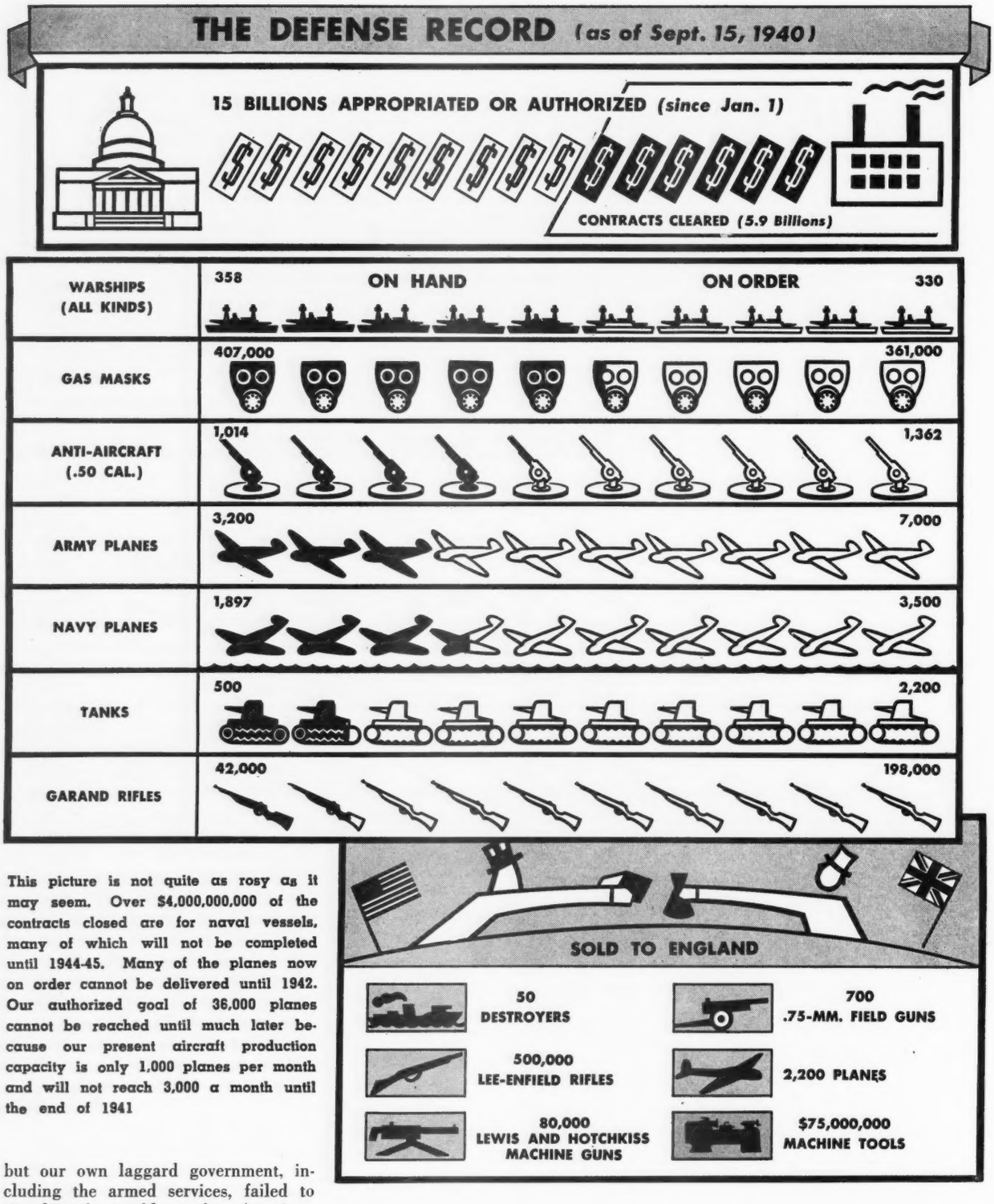


Elderman in the Washington Post

Politicians tell the public industry is to blame for delays in defense—yet the real bottleneck lies not with industry, but with the Congress itself



Charts on pages 43, 44, 46, and 47 by Irving Geist, © Factory Management and Maintenance



This picture is not quite as rosy as it may seem. Over $4,000,000,000 of the contracts closed are for naval vessels, many of which will not be completed until 1944-45. Many of the planes now on order cannot be delivered until 1942. Our authorized goal of 36,000 planes cannot be reached until much later because our present aircraft production capacity is only 1,000 planes per month and will not reach 3,000 a month until the end of 1941

but our own laggard government, including the armed services, failed to visualize the problems that American involvement might entail.

A handful of dollar-a-year men went down to Washington and poked tentatively at the job. They were given no funds, no definite responsibility, and precious little encouragement. They made a brief survey, based on the government's exceedingly inadequate data, and went home.

When the 1917 crisis broke over us, we leaped into a program of vast, powerful, but ill-coordinated activity. The war brought industrial chaos, price inflation, and wild buying with the several branches of the government bidding against foreign buyers and against each other. Transportation facilities were jammed.

Lack of coordination and lack of planning were chiefly to blame. The Army and Navy—the Army especially—had no real conception of what they wanted or needed. Few specifications were ready. Contracts were loosely and hastily drawn. In two years we spent $4,000,000,000 for ordnance, but only 133 guns and 600 shells reached France before the Armistice. In another year, by all accounts, we should have had a hugely productive, well-unified in-

dustrial machine back of our armed forces. But it was not until late in the war that the War Industries Board brought order to the scene with the establishment of the necessary research, coordination, and control.

Today? First of all stands the fact that our armed services have been studying their own needs and planning for the utilization of industry for almost twenty years. Taking the final report of the War Industries Board as a starting point, they developed the Industrial Mobilization Plan, a model of its kind. Hundreds of officers, specially trained in the Army Industrial College, have carried on a continuing study of raw material resources and industrial plant facilities.

This is not to say that all their plans have been perfect or final. The big point is that the plans exist and that they have value. Both the Army and Navy were ready with specifications and contracts when the big appropriations began to come through. Supply sources were known and duplications avoided thanks to work done years before by the Army and Navy Munitions Board and by the Planning Branch of the Office of the Assistant Secretary of War. Many of the new orders have moved straight down the channels marked out for them in surveys conducted by the Planning Branch's Allocations Division. And it is widely agreed that what Bernard M. Baruch once called "the old unwillingness to cooperate on the part of the Army and Navy" hardly exists today.

Surprised by Blitzkrieg

There is one big gap, of course. Foreign orders have not been big enough, except in aircraft, to expand and educate our industries for munitions production as they did in 1914–17. This time England and France made leisurely preparations for a long war. They held off on orders here even after the war began and were taken by surprise when the blitzkrieg blasted Flanders. The $2,000,000,000 of munitions orders that England is placing here now will be more of a problem than a help to our program.

In most other respects, however, 1940 America profits by comparison with pre-World War days. One of the clearest contrasts is to be found in the atmosphere of Washington itself—in 1917 a turmoil of contractors, promoters, and foreign purchasing agents all vying for preference; today a fairly orderly place where every effort is being made to centralize administration and *de*centralize operations.

Still another encouraging factor is the widespread discussion of "bottlenecks." The very fact that we have such a word is significant, for there was a time when the existence of bottlenecks was hardly suspected, much less discussed. We haven't begun to crack all our bottlenecks yet, but we have identified them and that's the first step toward eliminating them.

For example, the need of government-financed plants to build special munitions of non-commercial character was foreseen long ago. The Army and Navy have planned for perhaps $1,000,000,000 worth of such plants and have already gone ahead with four of them. Their character and location have been decided upon and there is a definite pattern to the plan for selection of sites. The flow of explosives will be from South to North; component parts of guns and shells will flow from East to West. Thus all new plants will be situated, where possible, "inside the mountains" as a precaution against air attacks. The voluntary cooperation of industry, working through the Defense Commission, has averted a potential jam in the machine-tool field. Plans are under way or in the offing to break other possible bottlenecks in armor plate, heavy forgings, and optical goods and instruments.

In two other ways we have a long head start on 1916–17. Military conscription, unthinkable then, is a fact today. Alien registration puts a check

DOES INDUSTRY COOPERATE?

*Testimony From the Records of Congress**

Representative Johnson (W. Va.): How is private industry cooperating with you?

General Wesson: Splendidly . . . the spirit of industry is absolutely fine and patriotic . . . I do not think they are out to make an unreasonable sum of money.

Mr. Johnson: Of course they ought to have a reasonable amount.

General Wesson: Yes, but they are not out to make a killing.

Representative Taylor (Colo.): They are not racketeering at the expense of the government?

General Wesson: No, sir.

Representative Ludlow (Ind.): Do you find private industry cooperative?

Admiral Stark: Very . . . cooperative in every way.

There is no evidence, Mr. Roosevelt added, of dilatory tactics by industry, and in support of this statement he quoted William S. Knudsen and Edward R. Stettinius of the National Defense Commission.—*New York Times,* Aug. 28.

MAJOR GENERAL C. M. WESSON
Chief of Ordnance

ADMIRAL HAROLD R. STARK
Chief of Naval Operations

**From hearings of the House Subcommittee on Appropriations on Second Supplemental Defense Bill, July 22–25.*

on sabotage that we never had before.

But best of all is the fact that we *have* a Defense Commission composed of some of the keenest, most competent business administrators in the nation. Despite certain handicaps, their work has been a living vindication of industry at every step.

A Dismaying Comparison

On all these counts Americans would have cause to congratulate themselves if 1916–17 were our only yardstick. But there is a *modern* contrast to be drawn. Germany, it is estimated, has devoted half her national income to armaments for five years at a total cost roughly computed at $100,000,000,000.

Now 100 billions buys about twice as much in Germany as it does here. That is the difference between the 72-hour week and the 40-hour week, between three-shift and one-shift operation, between enslaved and free industries.

The present Congress has appropriated or authorized some $15,000,000,000 for defense. Perhaps only 5 or 6 billions of this can be spent in the first year. Call it 10 billions, one-seventh of our national income. Even then we shall be getting only one-twentieth of what Germany already has—five years behind Germany.

If adequate defense is really the national objective, therefore, the streets of Washington and the halls of Congress should be filled with the cry, "Hurry, hurry, hurry!"

Yet after its first burst of activity when the initial defense appropriations were passed, Congress settled down to political football of the old-fashioned, peacetime brand. It had just five jobs to do—pass the second supplemental appropriations of $5,252,000,000; enact a law to enable industry to amortize plant expansion for defense purposes; suspend or repeal the profit limitations placed on airplane and ship builders by the Vinson-Trammell Act; adopt new taxes to finance the program; and pass a conscription bill.

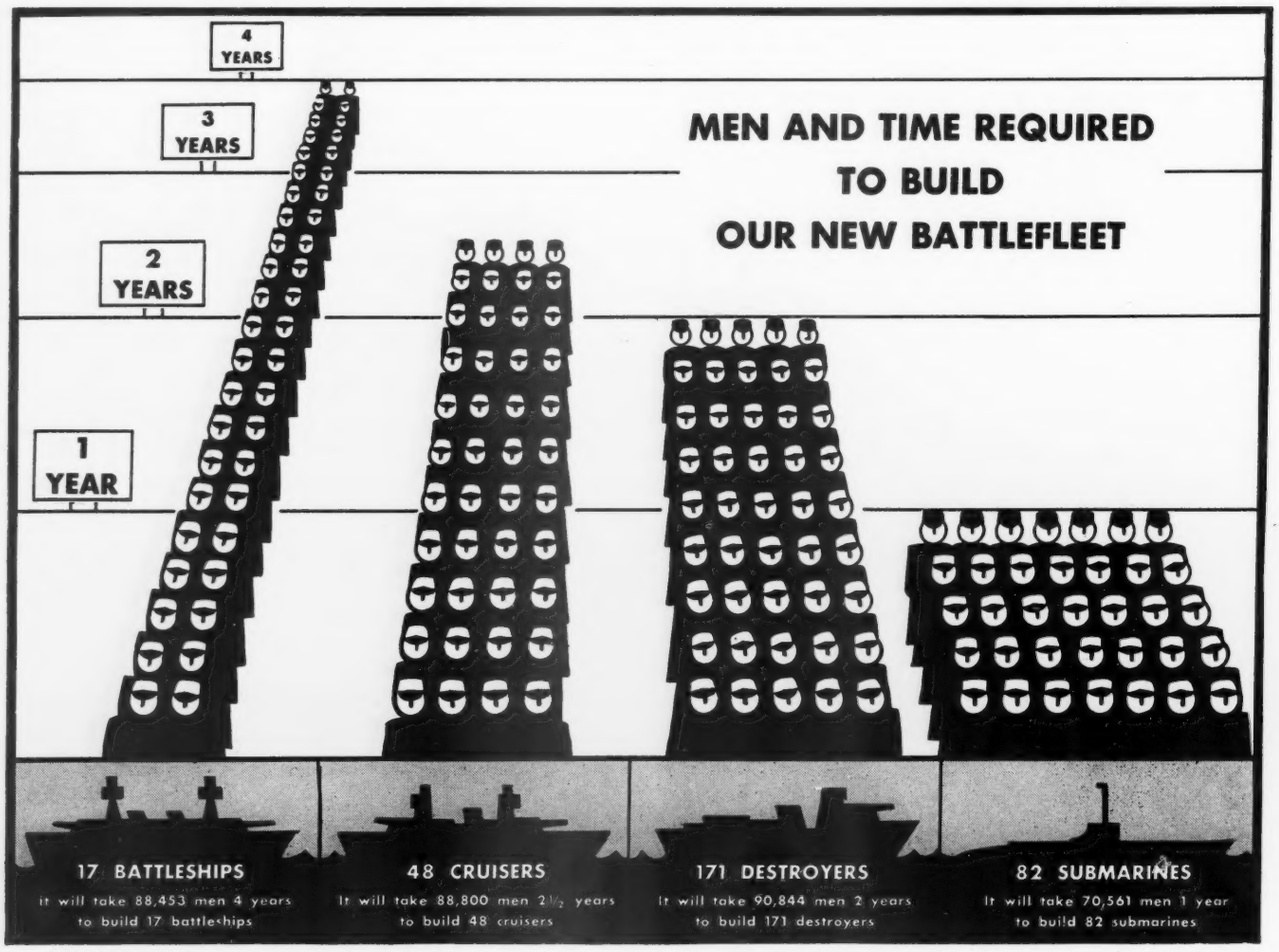
Neither the Senate nor the House showed awareness of the need for speed despite their bold declaration that the United States would defend the whole Western Hemisphere, including two oceans, with a skeleton army and a one-ocean navy. They got the cart before the horse and fell to squabbling over conscription despite the fact that manpower was the only immediately available item in the Army's long list of needs.

What the Army needed most was, and is, equipment. What industry needed was a chance to prevent loss—*not* assurance of profits—through the amortization bill. A year ago such a bill was recommended by the Army to Congress and to the Treasury. Congress failed to act. In the Treasury the suggestion was heard sympathetically by only one official, Under-Secretary John W. Hanes, who has since resigned.

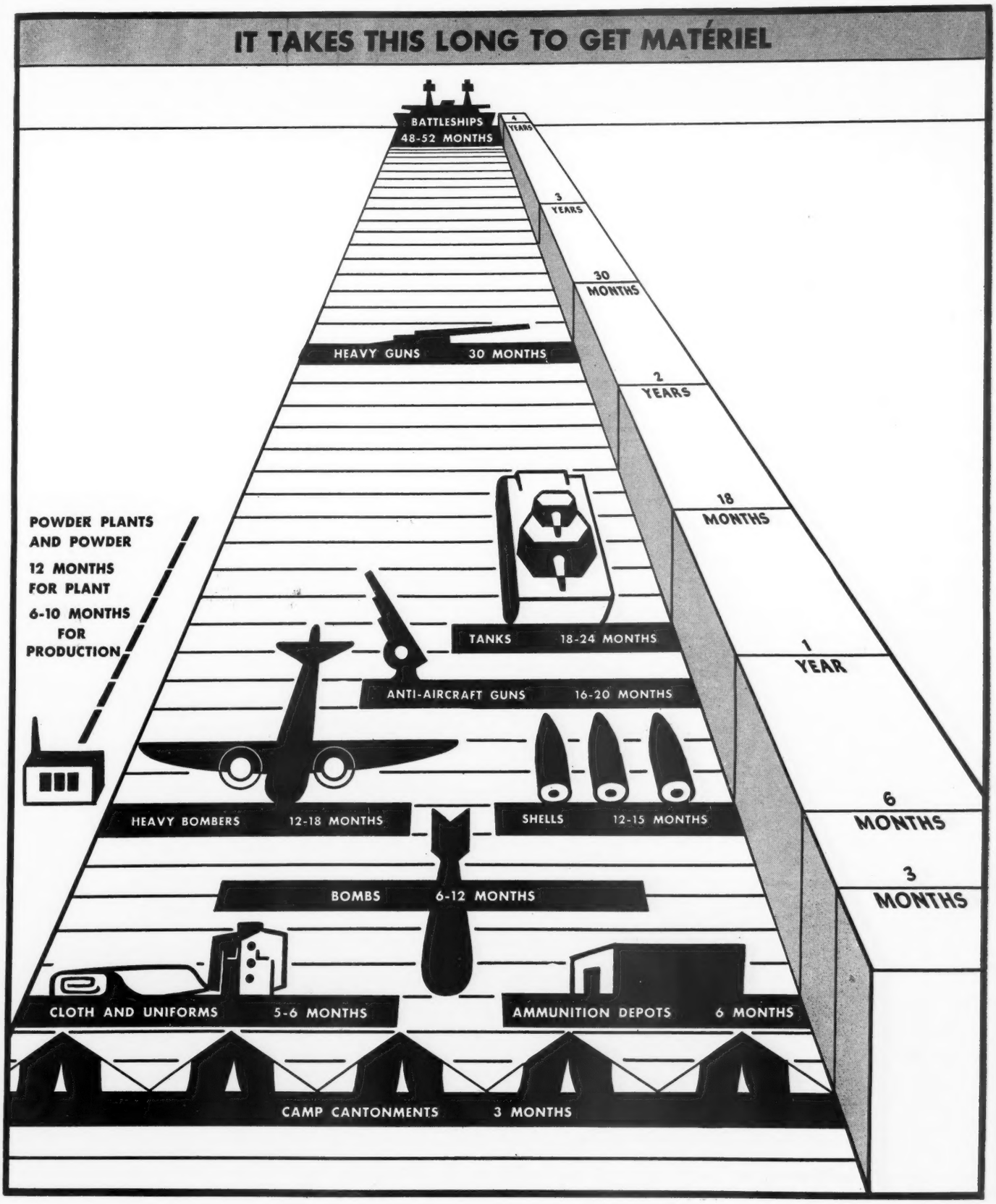
Finally an amortization bill was drafted. It should have been passed at once. Instead it was combined with the comparatively irrelevant excess profits tax bill. The Treasury is generally believed to have sponsored this move. If so, it is another example of the New Deal's ingenuity in wrapping up legislation that it wants with legislation that the nation needs.

This, of course, meant more delay.

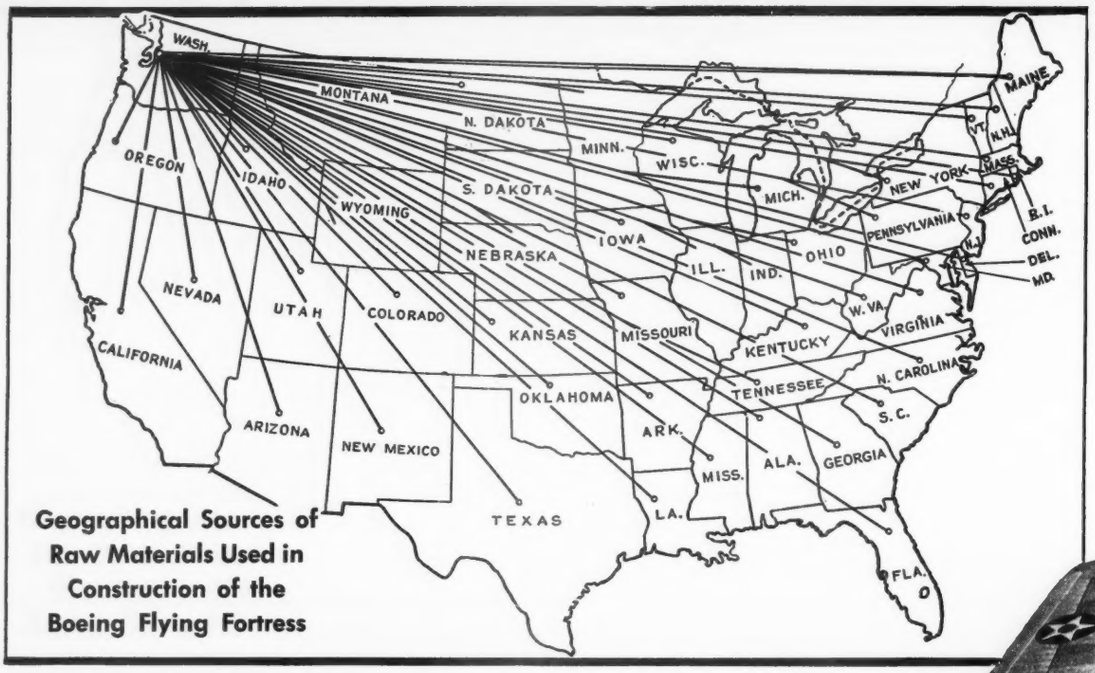
At that point a committee of leading industrialists went to Congress and to


4 YEARS
3 YEARS
2 YEARS
1 YEAR
MEN AND TIME REQUIRED TO BUILD OUR NEW BATTLEFLEET
17 BATTLESHIPS
It will take 88,453 men 4 years to build 17 battleships
48 CRUISERS
It will take 88,800 men 2½ years to build 48 cruisers
171 DESTROYERS
It will take 90,844 men 2 years to build 171 destroyers
82 SUBMARINES
It will take 70,561 men 1 year to build 82 submarines

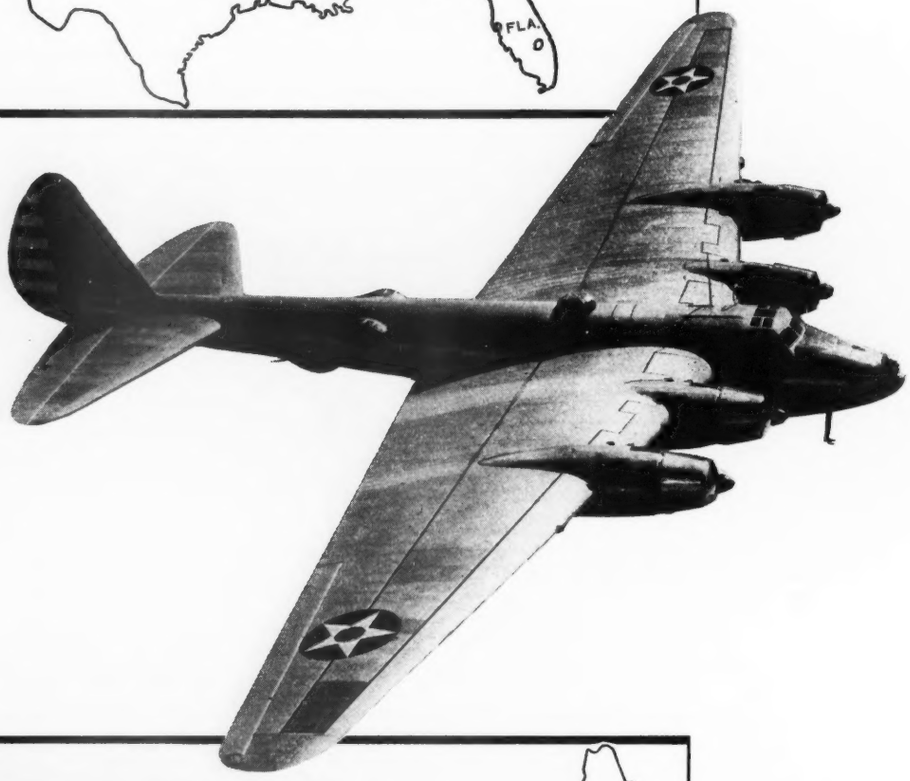
Also to be built are 12 aircraft carriers and large numbers of auxiliary craft for which man-hour estimates are not available



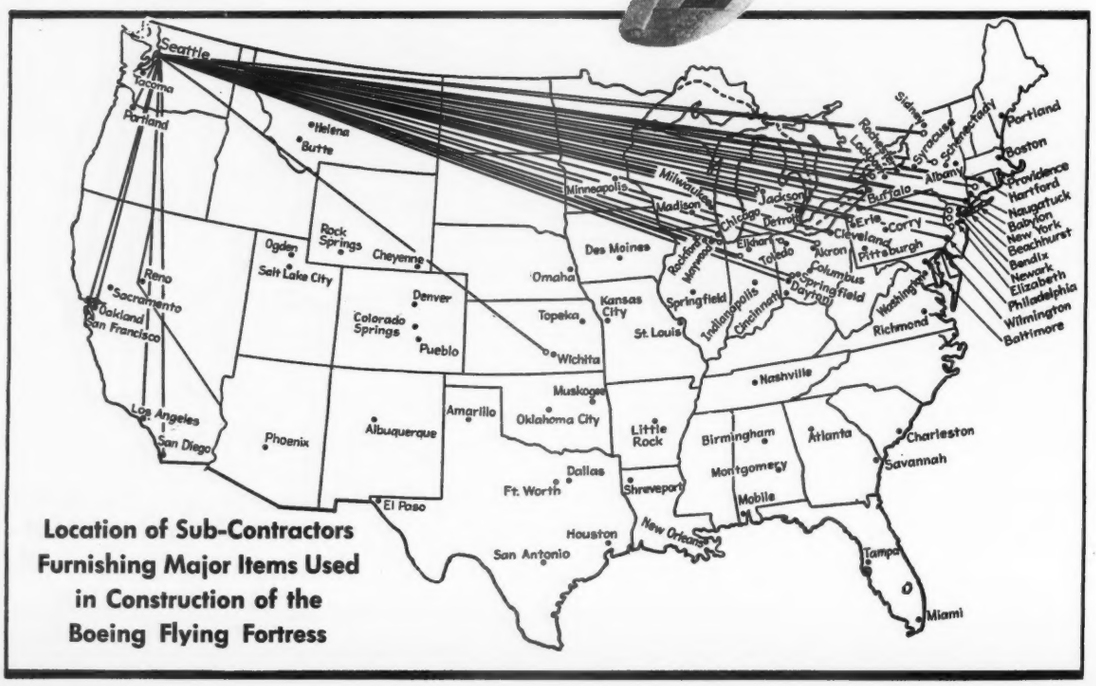
Army and Navy officials have stated that the periods of time indicated above will be required to secure adequate equipment for an armed force of a size considered by them to be the minimum for national defense. The exact size of this force is not disclosed. Hence this chart cannot be set up on a quantitative basis. However, it is of decided value in illustrating the great amount of time needed to effect the change-over of peacetime industries for large-scale production of war materiel



Geographical Sources of Raw Materials Used in Construction of the Boeing Flying Fortress



Planes are built in one plant, but they are *made* in hundreds of plants. To build a modern heavy bomber, Boeing Aircraft of Seattle must send to 33 states for raw materials and to 213 major subcontractors for parts. The transportation factor alone obviously is a tremendous one. These charts show why *it takes time*, 12 to 18 months, and costs money, about $250,000, to build this type of plane. It also shows why the profit limitations of the Vinson-Trammell Act have been a burden on the aviation industry—not because it seeks or makes big profits. But the vast amount of bookkeeping in which small companies must engage to prove that they, too, comply with the act cuts deeply into the small margin of profit they can make on the relatively small orders they receive. In fact it has often meant, for them, no profit at all



Location of Sub-Contractors Furnishing Major Items Used in Construction of the Boeing Flying Fortress

the Treasury and offered their help in drafting a tax bill that would fall most equitably on industry and at the same time yield the greatest possible revenue to the government. This plainly showed industry's complete willingness to meet the tax.

Nothing came of it. When, three months later, the long-awaited bill finally emerged from the House subcommittee it was hopelessly inadequate in its revenue provisions. In its first form, in fact, it gave promise of raising only about $300,000,000 in revenue—the cost of four battleships—in 1940. More delay still.

At time dragged on, the cry went up that industry was refusing orders and holding out for profits. The fact is that industry was necessarily postponing plant expansion, although many companies were freely spending money on plans and equipment to prepare themselves for defense production. The Defense Commission asked Congress to act on the amortization bill, and still the matter dragged.

A Warning Unheeded

It is hard to believe that many members of Congress could have heeded the earlier testimony of Col. H. K. Rutherford, chief of the War Department's Planning Branch, when he appeared before the Senate Subcommittee on Appropriations. There he explained patiently again what Army men have been telling Congress for years, that it would normally take 24 months to get industry into high gear for munitions production; that, with all the planning in the world, the time couldn't be cut much below 15 months.

Nor can many Congressmen have heard the rejoinder of one of their colleagues, Senator Maloney of Connecticut.

"I am terribly disappointed in the attitude of the Army in this matter," he exclaimed. "We had the same statement the other day by the men in charge of airplanes. Their ambition is to get ready in a period of 18 or 24 months when we are living in a period of wars being settled in 30 days."

To anyone who understands industrial problems, the achievement of Colonel Rutherford's goal of 15 months would seem a modern miracle. However, Senator Maloney at least displayed awareness of the need for speed.

Rep. Edward T. Taylor of Colorado, Chairman of the House Appropriations Subcommittee, put his finger on a good half of the trouble when he observed:

"I think it is the sentiment of this Congress to furnish whatever [defense] money is necessary or that can be used to advantage, *but when we bring up a bill on the floor we have to justify it to a lot of men who have not caught up on the present situation.* That is not only true of the Congress but of men throughout the country."

It is true that a nation's will to arm itself rises and subsides like the belligerency of an individual. Doubtless Congress' laggard attitude reflected a certain relaxation in public sentiment. Too, sheer ignorance of industrial problems probably benumbed many men who would not wittingly have endangered the nation by needless delay. But it made them the tools of an obstructionist bloc that has proved to be a 1940 version of 1917's "little group of willful men."

For chiefly political reasons, the conscription bill, when it finally came through, carried an irrelevant amendment so dangerous to industry as almost to nullify its benefit to the nation. This was the "conscription of industry" amendment to empower the government to commandeer on a rental basis any industrial facility with which no agreement on defense production could be reached by negotiation. The House amendment, as finally adopted, was better than the original Senate version—but it needlessly gives coercive powers to individuals in the government.

Beyond doubt this action was made possible by a barrage of attacks on industry prefacing its passage. The critics harped on industry's reluctance to close defense contracts until the amortization issue could be settled.

An Unwieldy Word

The great weakness of industry's position lay in the fact that "amortization" was such an unwieldy word and the issue behind it so complex as to defy public understanding. Unnoticed was the fact that as early as July 10 the Defense Commission, the President, the Senate Finance Committee, the House Military Affairs Committee, and even the Treasury (after some earlier and inexcusable stalling) were *in public agreement* on the need for action on amortization and profit limitation.

Unheeded were the assertions of military and naval chieftains that they found industry's attitude wholly cooperative, unheeded also the White House statement of August 28 that President Roosevelt could find "no evidence of dilatory tactics by industry." Likewise unnoticed was the fact that many companies had gone quietly ahead with expansion plans and had spent sizable sums in anticipation of defense orders. Forgotten was the fact that in the past many companies had used their own funds to make production researches which they gave to the government.

Heard, heeded, and noticed, however, was the outcry that industry was "on strike" for profits.

A "Smear" Job

Passing over the more obvious attacks of the anti-industry bloc in Congress, let us select for analysis the most artistic and elaborate "smear job" of that period. This took the form of an editorial by Len De Caux, nimble propagandist of the CIO, who, on August 26, declared:

"In the last war, American companies that wanted war business had to build their own plants to get it just as they do for any peacetime business. And there was still gravy enough in it to make many war millionaires.

"But nowadays that is not good enough for our patriots for profit. They expect the government to pay them not only for the goods it orders but also for any new plants they may have to build . . .

"Let's suppose labor should imitate capital and adopt some slogan like: 'Get wise! Amortize!' Before John Smith would go to work on any defense production, he would demand not only the full union scale but also a governmental guarantee of extra compensation for all extra expenses and extra skills acquired for the purpose.

"For instance, suppose he had to move to a new home for the job. He would list the expenses of moving and of building a new house for himself and his family. He would add all possible costs involved in learning a new trade or brushing up on an old one.

"In this and similar ways he could figure out a pretty tidy total of $10,000, say. This he would expect the government to pay him back at the rate of $2,000 a year for five years in addition to his wages.

"The companies argue that their new plant may be useless to them when defense production is completed and so should be paid for by the government. But John Smith can also argue, with greater justification, that when his defense job is finished he may have to move to another city and may not be able to occupy his new home any more; or, more than likely, he will not be able to find any more work at the trade for which he has become skilled for defense."

Mr. De Caux's gossamer-like logic contains its own contradiction, but how can his readers be made to see it?

John Smith's right to move around,

buy his own house, and choose his own job is one of the privileges of democracy for which he should be willing to fight if he has ever heard of a labor battalion or a concentration camp. John Smith's home, which he will probably buy with government help out of taxes paid by industry, will still have value in peacetime because people will go on living in houses whereas munitions plants will be worthless when no munitions are made.

A Job Costs $5,000

John Smith's job will cost some employer approximately $5,000 to create. John Smith's skill, if he has it to begin with, will command a good, big price. His training, if he needs it, will cost some employer hundreds of dollars. Even if the employer loses on this investment, Smith will still have his skill.

Finally, if John Smith owns a single share of stock in his own company, he can and perhaps should sue his employer for using his invested funds to expand plant capacity in the name of patriotism alone.

But if the amortization question was hard for industry to explain, the Vinson-Trammell problem was next to impossible. Here it was even easier for industry's critics to assert that a 12 percent profit was not enough for the greedy "fifth column of profiteering industrialists" (Mr. De Caux's phrase) among the naval and aircraft manufacturers to whom the act applied.

In vain did the aircraft industry point out that it needed a nominal profit of at least 12 percent in order to make any real profit worth mentioning at all. That is because of certain non-allowable deductions. But a phrase like "non-allowable deductions" is just as hard for the public to digest as "amortization."

The crux of the question lay, however, in the fact that the Vinson-Trammell Act was a burden on the aircraft industry simply because the mechanics of the law made compliance so difficult. The major companies were willing to comply. But there are as many as 536 subcontractors involved in the making of a big plane such as a heavy bomber. Each of these smaller companies was compelled to engage in endless bookkeeping to show that it was not violating the act. In view of the small size of the transaction, this often meant no profit at all—or even a loss.

While Defense Commissioner John D. Biggers explained all this to the press, Defense Commissioner Leon Henderson (an old New Deal business baiter by trade) nodded his head in agreement and added that "the difference over the Vinson-Trammell Act" was "not a question of profit limitation but one of red tape."

Henderson, incidentally, went vigorously along with the rest of the commission in a thorough defense of industry, answering the charge that management was "on strike" by the simple assertion that the program was beginning to stall "because we haven't got the money."

This was on August 24. By then it was evident that Congress was going to settle down and chew over the conscription bill for a few weeks more, letting the second supplemental appropriation bill go hang. The program had gotten about as far as it could without the needed tax laws and additional funds.

This also was the period at which the shortcomings of Congress and the lack of one-man leadership became revealed in their most glaring aspect as twin causes of a potential breakdown in the whole defense program. Congress' own delay had left industry open to attack and had thus created the atmosphere for the pernicious "industry conscription" amendment to the Burke-Wadsworth bill, a maneuver that Wendell L. Willkie charged directly to White House inspiration. This measure originated in the Senate. The House was working meanwhile on Vinson-Trammell Act suspension. Whereupon the Senate, acting as though it had never heard of the House, approved the Adams amendment extending the Vinson-Trammell Act to all industry. Fortunately this was later dropped.

But there are far too many such examples of the helter-skelter nature of our government's relations with itself during one of the most critical junctures in the nation's history. At one point the President was in open disagreement with a United States Senator (Byrd of Virginia) over the number of planes on order by the government.

Another especially revealing instance of non-coordination occurred not long before when Treasury Secretary Morgenthau, took it upon himself to confide to Lord Beaverbrook that Great Britain might shortly expect to receive 3,000 American planes a month. There was nothing wrong with this statement except that such a schedule would require 18 months' total production of our machine tool industry and that our total aircraft capacity, then below 1,000 planes a month, was not expected

STEWART-WARNER CORPORATION

Chicago, Illinois
September 3, 1940

TO THE EMPLOYEES OF
STEWART-WARNER CORPORATION:

STEWART-WARNER AND DEFENSE

In the semi-annual report you will note that the personnel of the company and its manufacturing facilities have been offered to the country. This offer has been made in your name and that of every employee of this company.

This is a business made up of real Americans and each and every one of us wishes to do his part in the coming months or years, for we realize that as a Nation we are in the most serious times we have ever known.

We and others like us are American industry.

There has been a lot of bunk about industry in the last few years. The talk still goes on. Statements are in circulation today to the effect that American industry is holding back; refusing to cooperate with the Government; demanding large profits; etc.

Some people believe this.

If your friends ask you what your company has done so far, you can tell them this:

Your company has bid (on a competitive basis) on ten millions of dollars of Government work against many other companies.

So far we have been awarded approximately two million dollars worth of Government contracts. We have already begun making delivery on some of these contracts. The prices at which they were taken are such that up to July 31, we lost $60,000 on what we shipped. This loss represents what we have paid out of our own pockets to learn how to do our job. That is not profiteering.

We have purchased, or have on order, over $450,000 of new machinery. We are buying this machinery with our own money. That is not refusing to start until the Government finances us.

There are limits to what we can do, but we have reason to be proud of what we have done so far.

There is one kind of patriotism that stands on the street corner and makes a lot of noise, and another kind that buckles down to work and does the thing that it knows how to do best.

This is our country - and it's about the only country left where a man can call his soul his own. If we want to keep it that kind of a country we must all take a direct and personal interest in what goes on.

Truly yours

J. S. Knowlson

President

Many firms have acted to aid defense despite Congress's delay on needed laws. In this letter, J. S. Knowlson, President, explains Stewart-Warner's policy to employees

AMORTIZATION—*a simple case showing what this big word means*

Scene: The John Q. Smith Manufacturing Company, Anywhere, U. S. A., which makes 100,000 widgets a year and employs 100 men. At his desk is John Q. Smith, President.

(Enter Uncle Sam)

Smith: Morning, Uncle Sam. What can I do for you?

Uncle Sam: Smith, I want you to make widgets for defense use—first-class widgets at a fair price.

Smith: Glad to help. I'll make them good. I'll make them fast. And I'll charge only enough to meet my costs and leave a little for my stockholders.

Uncle Sam: That's fine. But I need more than you can make. Can you double your output?

Smith: Let me see. I'll have to add a building. I'll have to buy new machines. I'll have to hire and train more men.

Uncle Sam: Go right ahead.

Smith: That means I'll have to borrow money. I'll gladly do so if you can promise to go on buying.

Uncle Sam: I'm afraid I can't promise you that. What would happen if I should stop buying?

Smith: I'd be stuck with all that useless new equipment. My creditors would lose. I'd be lucky if I could keep the company together and go on employing my present 100 men.

Uncle Sam: All right. I'll do something to reduce your risk. Congress will pass an amortization law—

Smith: What does that mean?

Uncle Sam: This. You can write off your new investment much faster than usual by deducting 20 percent of its cost from your taxable income every year for five years. This doesn't mean that I'm *giving* you the new equipment but that I'll forego the tax on the amount you set aside to pay the extra debt.

Smith: Well, that gives me a fair chance. If you go on buying for five years at a price that's right, I'll break even. Of course, if you *stop* buying within five years, I'll still take quite a loss. But that's a chance I'll have to take. Okay. When do we get going on the new orders?

Uncle Sam: As soon as the Amortization Bill is passed.

* * *

Three months go by. Congress gets all mixed up in an argument over the Amortization Bill, which has meanwhile been combined with another bill to collect new taxes on "excess profits."

While Congress argues, Smith waits. He doesn't worry much about the excess profits tax because he knows and expects that the government will take most of his profits in order to finance the defense program. But he does want the amortization problem settled so he can go ahead and make widgets for Uncle Sam.

The public waits, too. And it gets impatient—with Mr. Smith. As a matter of fact, Smith has done the only thing he could do in fairness to himself, his stockholders, and Uncle Sam. The Army says he's right. The Navy says he's right. And the Defense Commission says he's right. The public should be impatient with Congress and not with Mr. Smith.

If the public could only understand that big, strange word, amortization, it would quickly rebuke Congress for having stalled so long on the defense tax laws. Factory's readers do *understand, of course. But some of their friends don't. This little story is told in the hope that it may help readers explain industry's position to doubting Thomases*

to reach 3,000 a month until the end of 1941.

The Morgenthau announcement made good reading in London but it proved startling to Army, Navy, and Defense Commission officials. However, they have no authority to control or prevent actions and statements that may, like this one, prove injurious to our own program of national defense.

This illumines FACTORY's earlier statement that the Defense Commission is not, in reality, a defense commission at all but an advisory body which is likely to be criticized some day for failing to perform certain duties that were never allotted to it.

Must Work the Hard Way

A real defense commission would be charged with full responsibility to provide for the national defense and would be given full authority to do so. This Advisory Commission does have authority of a sort, the informal backing of the White House. In consequence it is no orphan in the alphabet family. Quite the contrary. By and large it receives excellent cooperation from the other government agencies. So, while the members of the commission can give no orders, they get things done, a surprising number of things.

But they have to operate the hard way. They have to persuade, defer, and compromise. They have to spend days over the intricacies of interdepartmental diplomacy when a clean cut "must" order would accomplish the desired result in an hour.

It is fortunate for the nation that Mr. Knudsen, Mr. Stettinius, and their associates are such practiced hands at business diplomacy and at getting good men to work for them. There are many stories of the ways in which they have solved production problems by means of a few adroit long distance phone calls and a conference of just the right men. The commissioners and their staffs have also applied their years of experience to the enlightenment of government officials who have never had direct contact with business. For example, a congressional committeeman was justifiably concerned over an Army estimate of $4 per square foot for construction of an Army storage depot. He had noticed that the Navy was estimating only $2.75 for what seemed to him to be the same sort of job. So he asked Mr. Knudsen about it.

"The footings and the floorload determine the cost of a multiple story building by the square foot," Mr. Knudsen replied. "I had one which came up and I questioned it and had them go back and get drawings and other details and we found that, due to the condition of the soil, the difference in the cost of the footings would amount to $1,000,000 and that changed the picture and I had to admit that the cost was not excessive. I have in my possession records of reputable architects from all over the country giving the cost of different kinds of buildings in different sections of the United States, so I have something to check that on at all times."

Said another Congressman: "That is all checked before it is approved?"

Said Mr. Knudsen: "Yes, sir."

Now consider that Mr. Knudsen and Mr. Stettinius have between them 100-odd seasoned industrialists who scrutinize each buying operation in the light of their own knowledge and long experience. The public can feel confident that there has been no extravagance in the $5,900,000,000 of contracts that the commission has so far cleared.

To the commission's further credit stands the fact that it had the courage to come out for the amortization bill, Vinson-Trammell Act suspension, and other measures helpful to industry. And to its eternal credit stand the methods it devised to keep the program moving when Congress failed to act.

Obstacles Overcome

First of these was the "letter of intention," a written declaration by the government of its intent to buy. This stopgap gave manufacturers *something* they could show their stockholders when they went ahead and invested in new tools and equipment. Second was the "bankable" contract which gave certain contractors a chance to borrow money from private sources and begin expansion without waiting for amortization. Under this plan the government agrees to buy the new facilities in five equal annual payments, after which the contractor, if he so desires, may buy the plant back from the government at a negotiated price.

What progress the defense program has made in the last few months is thus owing in very large part to the commission's work. The armed services would have found themselves up against a stone wall of legislative obstruction with no hope of relief had they not had the commission for liaison with the public, with Congress, and with industry.

But the commission is sharply restricted by three essential limitations. First, it has no veto powers over contracts or anything else of importance but must suggest and persuade in the hope that the White House will continue to back it up. Second, it has no responsibility for determining military or naval requirements. The armed services do that. The commission is just a super-procurement agency, reviewing purchases. Let us say that today the Army asks the commission for X tons of tin for the stockpile, or the Navy wants X thousand crankshafts for airplane motors. Two years from now, it may become apparent that the Army really needed $2X$ tons of tin and the Navy really needed only $\frac{1}{2}X$ crankshafts. Then the *commission* may be blamed by an unthinking public for obtaining the wrong quantity. Yet it had no choice.

Third, the commission is very specifically supposed *not* to have anything to do with legislation—even when it finds its path strewn with legislative obstacles. Thus it can only mildly recommend the things that need to be done and thereafter remain silent.

Needed: A Boss

Finally the commission itself needs one-man leadership for the sake of sheer efficiency. Nominally it is supposed to report to President Roosevelt and he is supposed to be, as he told Knudsen some time ago, "the boss." But many of the commission members feel privately that it would be much better if they had a boss of their own who would in turn report directly to the White House. It is a question how much time the President can give to the detailed surveillance of a seven-man headless commission in view of the demands made upon him by the cabinet, the Congress, and a political campaign. The commission is only one of his hundreds of jobs. And it was a matter for congressional debate recently whether Jesse Jones was big enough to hold the 27 jobs involved in dual tenure of a cabinet post and the chairmanship of the RFC.

In the event of war or a serious war crisis, of course, the one-man leadership of defense would become paramount. Then the Industrial Mobilization Plan would probably be called into play and a War Resources Administrator of vast authority would be installed.

No one wishes for war or for dictatorship. Yet the fumblings of a creaky Congress, intent on politics and business baiting have given cause for concern. The fact that the bickering was allowed to continue so long without positive reproof from the White House is by no means reassuring. It may be that, in the last analysis, the effective rearmament of a democracy at peace can be accomplished only when the rank and file of the people demand unity, insist on leadership, and compel Congress to act. This unity may still be ours if the impatience of the people is directed at the real cause of the delay.

Must Model Changes Mean Parts Losses?

In most cases, yes; but the trick is to see how little scrap you can get by with, to figure out to what extent parts on hand can be profitably used up, to determine when the close-out should come. Here's how to compile data that will indicate the answers to these questions

R. F. HURST

Production Manager, Roberts & Mander Stove Company, Hatboro, Pa.

Born and raised in Pennsylvania, Mr. Hurst got his B.S. in civil engineering at Villanova in 1932. After some odd jobs at surveying and a turn with the Philadelphia Planning Commission on traffic hazards, he became a junior electrical engineer with RCA Victor in Camden, N. J. From there he moved to the George S. May Company in New York, and still later to his present connection. Here he has served as time study engineer, cost control man, and special assistant to the general superintendent, assuming his present position of production manager in 1938. Meanwhile, in 1937, he was awarded a professional degree of mechanical engineer by Villanova. He says that aside from golf his chief hobby is promotion of modern cost control

PRODUCTION MEN continually face the bugaboo of "engineering changes." To add to this trouble, market conditions have been such of late that inventories, especially of raw materials, have been increased out of proportion to current demands. Nevertheless we find competition forcing introduction of redesigned or new products to such an extent that it has become common practice to change models or create new ones constantly throughout the year. Each new design means new parts, new parts mean obsolescence of old parts, obsolete parts mean *losses*. Today's larger inventories further complicate matters.

Generally, by the time a new design has crystallized in the minds of the sales and engineering departments, it has become an absolute necessity and the change-over must be made as rapidly as possible. Such changes breaking into any production schedule cannot help finding an unbalanced stock condition. The year's profit or loss may hinge on the date on which the change becomes effective.

Since it is management that appre-

Checked By R.T.H. CLOSE-OUT INVENTORY NO. #1 Date 6-28-40

Model C1216KV

Part No.	Description		Location	Work-In-Process Quan.	Unit Cost	Inv. Value	Location	Finished Parts Quan.	Unit Cost	Inv. Value	300 Assemblies Detail	Expenditure	Detail	Realization
S6880	Outside side	1	K-11	60	$0.328	$19.68	2A-121	0	0	0	F60-240x	$149.28	60P	$19.68
S6881	" "	1	K-12	340	0.328	111.52	2B-121	0	0	0	F300	186.60	300P	98.40
A6891	Top finishstrip	1	K-121	0	0	0	K-164	0	0	0	300	137.97	0	0
A6878	Top	1	K-152	45	0.422	18.99	K-168	0	0	0	F45-255x	201.51	45P	18.99
S6879	Top lining	1x	K-56	200	0.263	52.60	S-11	0	0	0	F200-100x	272.52	200P	13.77
S6889	Cover	2	K-76	800	0.383	306.40	A-76	30	0.894	26.82	F270	138.10	30-270P	333.22
S2579	Bar	1	C-4	230	0.102	23.46	S-41	122	0.222	27.33	F178	21.30	122-178P	45.48
S2588	Legs	4	C-4	5441	0.224	1218.78	S-42	130	0.500	64.87	F1070	294.25	130-1070P	304.55
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Figure 1. Inventory costing sheet and estimate of expenditure and realization for one inventory item. Two or three other estimates besides this one for 300 assemblies would be worked out to provide data for plotting the several graphs shown in Figure 2

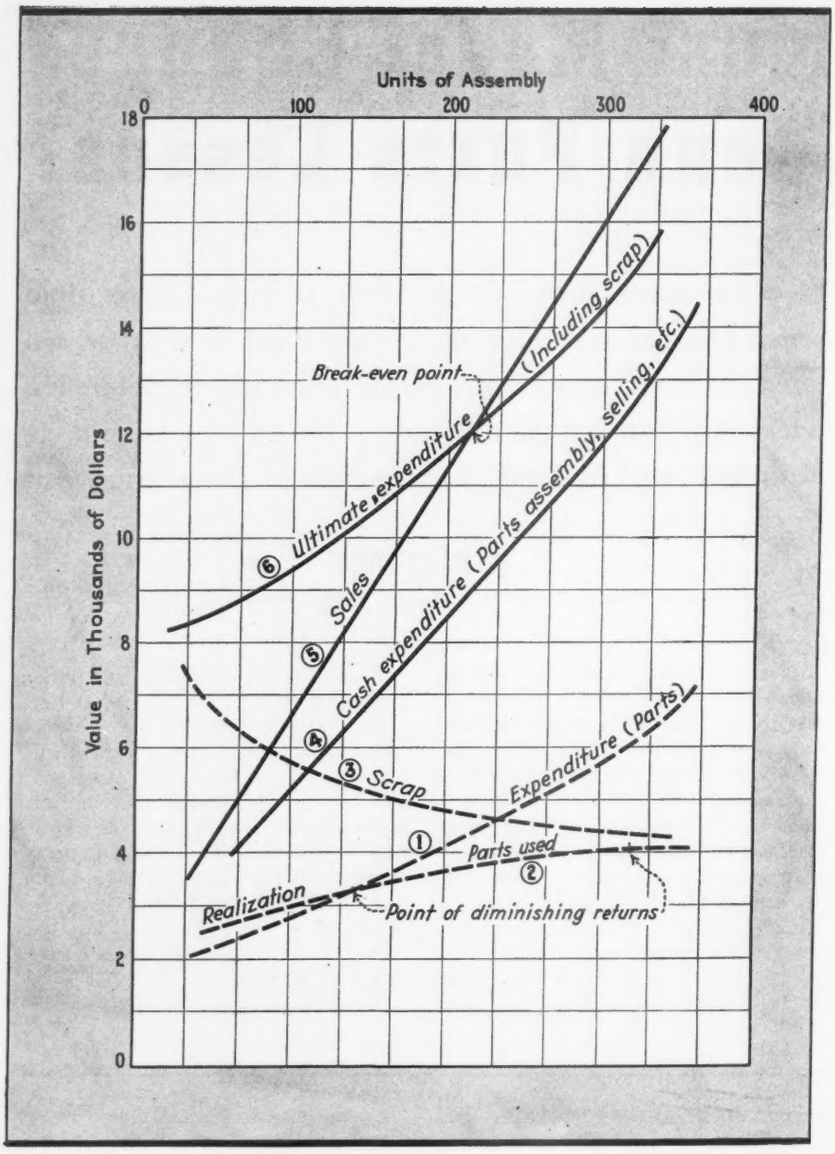


Figure 2. Chart showing the break-even point and points of diminishing return guide management in its decision whether or not to make more assemblies will be profitable

ciates the need for revision of the product, it is only management that can balance the need for a change against the inventory on hand, and thereby determine the proper point at which to make the change. The production department must find some short practical method by which to supply information on the myriads of detail concerning its inventories, so that management is in turn enabled to make intelligent decisions on the change-over without looking at a long detailed list of parts.

Over the past few years we have evolved a definite procedure for presenting the effect of an engineering change on our various inventories. Primarily, this procedure is used for developing the length of time required to make the best possible use of parts rendered valueless by the engineering change. The same procedure has been found to be of value, however, when closing out an entire line at the end of a season. The problem is to determine the number of units to be built for a close-out, or a liquidation, of some model. It is the purpose of this article to present one solution by outlining a particular method of, first, gathering the necessary information on the parts affected; and, second, arranging the data for easy, accurate analysis.

In either case, the problem resolves itself into the determination of just how much additional expense should be incurred in securing the maximum economical realization of the parts on hand. Thus, if incomplete sets of parts valued at $6,000 are remaining, an expenditure of $1,000 might result in enough complete assemblies to realize $3,000 of the inventory. Such a realization is practical and economical. On the other hand, the quantities remaining may be so unbalanced that an expenditure of $1,000 might realize only $700 of the inventory.

Such a realization is of questionable value, depending on several other pertinent factors. Instead of a few hundred dollars, the realization might be $70,000 for an expenditure of $100,000. Such a realization could be vitally important, even though the proportionate expense is the same as above. The future sale of the older product might be doubtful and not worth the risk of additional expenditure, or perhaps the ultimate value of the change is higher than value of the parts remaining after the change has been made.

Numerous and wholly different factors have to be considered in the ultimate decision. Nevertheless, while the viewpoint may vary for each particular business, the angle of approach can be the same. For the present, let us concern ourselves with securing the detailed information so necessary to such vital decisions.

First a Physical Inventory

The first step to take after an engineering change or close-out has been ordered is to secure a complete inventory of all the parts affected. It is wise to take an actual physical inventory of all remaining parts, regardless of the exactness of the perpetual inventory system in use. Small quantities of parts always seem to accumulate in several places along the route of processing.

As an initial action, it is advisable to send a general notice to all foremen or supervisors advising them of the close-out of certain models or parts, making them responsible for any material not returned to stock after a definite date. Such notices will always start a flow of small quantities of material into stock. In many cases the total value of material supposedly left on hand will be as much as doubled by the resurrection of such odds and ends.

Having centralized material as far as possible, we are ready to proceed with the inventory. To facilitate the returns, to act as a check, and to expedite the costing of the inventory, a form similar to figure 1 is of great service. Note that an identification number is given to each inventory. These numbers are assigned according to the potential market of the product, with the greatest as No. 1, in order to make the best possible use of common or universal parts. These forms can be easily prepared in the office on any duplicating machine.

Before being released to the stores division, each item on the bills of ma-

terial for the models or assemblies to be discontinued, except for those parts which are to be used in the forthcoming season, is listed in columns *1* and *2*. At the same time it is easy to show by means of an asterisk in column *3* whether or not the part is used on any other assembly, whether the part is a standard part or a special part. It is helpful to establish a small inventory card for each standard part if more than one model is being discontinued, particularly if the paperwork is all being done at one time. Thus a check can be easily kept of the quantity appropriated and the quantity still available for other close-outs. This record is another reason for giving each inventory a reference number.

Management Gets Report

The stores division should be responsible for filling in columns *4*, *5*, *8*, and *9*, giving the location, quantity, and type of finish of all remaining parts. The location of the various parts is of great importance when final assembly is actually started. The sheets should next be turned over to the cost department which supplies, in columns *6* and *10*, the unit cost of each part according to whether the material is in process or in a finished state. Columns *7* and *11* are then computed and totaled.

At this point, a report of the value of the goods about to become obsolete is presented to management. If the decision to make the change is not altered because of the value of the inventory, then it is necessary to decide whether to assume the loss immediately or to supply further information on salvaging as much material as possible.

If the latter decision is made, the production office, after reviewing the results of the inventory, determines the possible quantity of assemblies that can be made. Bearing in mind that information is to be presented graphically, expense should be determined at four or five different points in order to obtain sufficient data to plot a curve. If practically all quantities are low, it would be practical to assume that 10, 20, 30, 40, or 50 assemblies are possible. If the quantities in the inventory are high, it would be more feasible to determine the expense of producing 100, 200, 500, 1,000 assemblies. Such points can be assumed easily enough by glancing through the inventory sheets.

Once the approximate quantities to be built have been assumed, calculations can continue. The production office takes the first quantity of assemblies and fills in column *12* with the details of expense necessary in finishing work-in-process or in fabricating additional parts to produce the quantity noted. In column *14* it fills in the detail of the realization of inventory according to the number of parts on hand that can be used.

Thus in column *12* it could be denoted (by symbol *F*50) that it is necessary to finish 50 pieces which are in process and in column *14* (by symbol 50*P*) that the 50 pieces now in process can be salvaged.

If 100 assemblies were to be built and we still had only the same 50 pieces in process, column *12* (Expenditure) would show (by symbol *F*50–50*X*) that we had need of finishing the original 50 pieces and of both fabricating and finishing an additional 50 pieces. Column *14* (Realization) would again show (by symbol 50*P*) that we are salvaging the 50 pieces in process at the moment. Columns *12*, *13*, *14*, and *15* are repeated as often as necessary, depending on the number of points chosen, and the details are furnished according to the suggested quantity to be made. The cost department makes the extension and totals columns *13* and *15*. With the tabulation now complete, we are ready to chart the information obtained. The graph will picture the point of diminishing returns, enabling a decision on our close-out.

Plotting the totals of columns *13* and *15* for the various suggested quantities of assemblies presents a picture similar to Figure 2. The intersection of curves *1* and *2* (136 units) may be considered as one point of diminishing returns. It is the point where the expenditure required to finish parts already in process and to make enough new parts to complete assemblies becomes less than the value of inventory salvaged. If, however, we consider a product whose immediate potential sales are considerably more than the quantity indicated, then we should consider the point where curve *1* flattens out (320 units). At that point the amount salvaged decreases sharply in proportion to additional expenditures. Many would consider this second point as a point of diminishing returns. Which of the two is the actual point of diminishing returns depends on individual circumstances.

There are no hard and fast rules for applying this information. It is the purpose of this article to present a method of putting the data in useful form.

(Continued on page 142)

Pete Gets New Slant on New Methods

JAMES CURTIN
All-Steel-Equip Company, Inc.
Aurora, Ill.

PETE WAS PLENTY ANGRY. The word went around the department, and the boys gave Pete's machine a wide berth when passing it. Ordinarily a fairly gentle individual, Pete has that characteristic common to all piece workers —he doesn't like to have his rates tampered with; they are sacred to him and he guards them jealously.

Today was the fourth time in the last few months that his rates had been reduced under the guise of "improved methods," and Pete had had just about enough of it. He exploded at brief intervals to his helper, the general idea behind his words being that the company had a lot of nerve cutting rates when they were making so much money and that, after all these years of faithful service, Pete deserved better treatment than this.

Of course, in his helper's eyes, Pete was a king and could do no wrong. So his helper agreed with Pete and added a few choice remarks of his own about the "capitalists" (that indefinite body to whom most of the worker's ills are attributed).

The quitting horn soon sounded, and Pete stamped over to the card rack, punched his card with a bang that made the time clock wince, and started for the door. He answered the superintendent's cheery "Good night, Pete," with an unintelligible grunt.

When cool air outside struck Pete's forehead, it calmed him to a point where he was once more conscious of his surroundings and what he was doing. Walking down the long line of parked cars, his troubled mind carried him back to the "good old days" when rates were high and life was sweet.

As he walked along, Pete mused to himself, "Strange that I never noticed

(Continued on page 144)

"This Is No Time for Politics"

Dinner-pail voters the country over are giving our economic problems the biggest workout ever. They are unanimous in saying *"This is no time for politics."* Defense scared and depression scarred, they are deciding how to vote November 5 by pondering, not old-time party loyalties, but which leader will give them, their families, and their country the greatest protection and stability

WHITING WILLIAMS
Consulting Editor

WHAT is the big-city wage earner thinking just now about the presidential campaign, about conscription, the "swap" of destroyers for bases, WPA, unemployment, and all such-like?

In addition to my usual contacts with this group, I have, first in June and now again in September, had investigators put these and similar questions to factory workers in the six largest industrial centers of the Middle West. The purpose has been partly to secure a tally of political preferences but also to learn the whys and wherefores, the background, of the worker's present-moment thinkings and feelings.

These columns are not the place for setting down the arithmetic of the as yet unfinished check-up. But the readers of FACTORY can hardly fail to be interested in some of the less political angles of the state of mind discovered.

Talkfests and Bull Sessions

Take, for instance, these two outstanding points: First, the workers are joining the rest of the citizenry in staging just now the liveliest "talkfest," the most active of what the college boys call "bull sessions," this country has seen in a long, long time. Second, this openest of "open forums" is devoting very little time or attention to "talking politics."

Outside the plant gate, at lunch counter and over the brass rail, everywhere, the wage earners are giving the country's most pressing decisions a grand workout. Towards making a good job of it, the participants are as never before listening to the radio, especially the news commentators, watching the news reels at the movies, and reading the newspapers, including, believe it or not, the editorials though not so much as the columnists.

But they show slight interest in party labels, platforms, or other old-time paraphernalia of politics. They see the contest as between two *persons*—with both these persons representing traditional political issues vastly less than certain highly individual, party-free methods of approaching and handling the different questions to be decided. This interest in persons instead of party seems to have put the kibosh on such political campaign gadgets as either slogans (Bugs Baer calls them "misinformation in tabloid form") or torchlight processions. But it certainly lowers the "heat" and raises the "light" content of the campaign, if it can be called campaign. Among the workers the discussions are notably shy on animosity and extremely long on the desire for "light." "What we want is *more information!*" So much so that the investigators find it hard to finish with one individual or group and go on to others. Many workers express pleasure that their opinion is being sought, describe themselves as "undecided," "on the fence," and then proceed to beg the questioner for all possible fact or opinion.

This unique "de-politicalizing" of the campaign is mostly the result of the war. What seems to have happened is only another proof of the way workers as well educated as ours can be expected to tackle their problems—like this:

Hitler's victories last May first gave us all a bad case of jitters. But after a few days and weeks of listening, reading, and discussing, and especially after the French collapse and the British resistance, the workers joined the rest of us in becoming less jittery, less emotional. They boiled the hectic *war* scare down to a *defense* scare. This, then, they proceeded to boil down still further to a defense *job*.

This job they seem to think too vital to be left to impersonal parties, platforms, or policies—in the same way that we humans, when in a jam, always seek protection at the hands not of platitudes or philosophies but of some trusted leader-person,

"Promises and politicians," so runs the talkfest, "brought about the mess over there. This is no time for politics! How can we be sure of quick, efficient results for every move we make?

"We want the *man*—Democrat or Republican—whom we can trust—trust to keep us out of war as long as possible but to prepare us at once without hot air and without waste."

Confidence in the Man

So the workers are discussing next month's election largely in terms of their confidence or lack of confidence in the ability of the competing leader-persons to handle the vital job of national military security—with this job likely to shift with each day's news from Europe. Hence these "undecided" voters, along with the universal hunger for news of events and for information as to the person who can make a proper adjustment to them.—"It all depends." "With things happening so fast, how can a fellow decide?" "What would Candidate So-and-So do if such-and-such were to happen?"

How, furthermore, can you have a genuinely "political" campaign when parties and candidates show so little difference in their proposals for solving the Number One Public Problem of Defense?

So it is part of this "de-politicalized" campaign that the workers, outside of a small, vociferous, and mostly radical fringe, show slight opposition to helping Britain, swapping destroyers, or conscripting an army.

What, however, is to be noted is this—that, with every day Britain continues to stand firm, the original war scare and national defense tend to give way somewhat to family and personal security. "The draft," say more than a few of the oldsters, "should give us guys a better chance at a job."

No wonder that this complex problem of national military and personal economic security is felt to call for a minimum of political hokum and a maximum of trustworthy information and thoughtful discussion. No wonder also that, like all the rest of us, the wage earner, thanks to both the war and the depression, is deciding how to vote November 5 by pondering, not his old-time party loyalties, but "which leader will give me, my family, and my country the largest amount of protection and stability?" And then, again like the rest of us, answering the question in the light not so much of campaign speeches as of his own individual experience and observation.

Surer—or Less Sure?

Has the New Deal served me and my neighbors satisfactorily? If the answer is not decisive, then what kind of leader-person do the New Deal's results show its author to be? Will my own and my family's future be surer or less sure under such a leader—in war and also in peace?

How good has, for instance, the WPA been for me or my neighbors? "We were saved from starving!"—"You can't monkey with a man's stomach," say the pros. "A good stop-gap," reply the cons, "but makes too many chiselers."—"Has made more bums than anything ever."

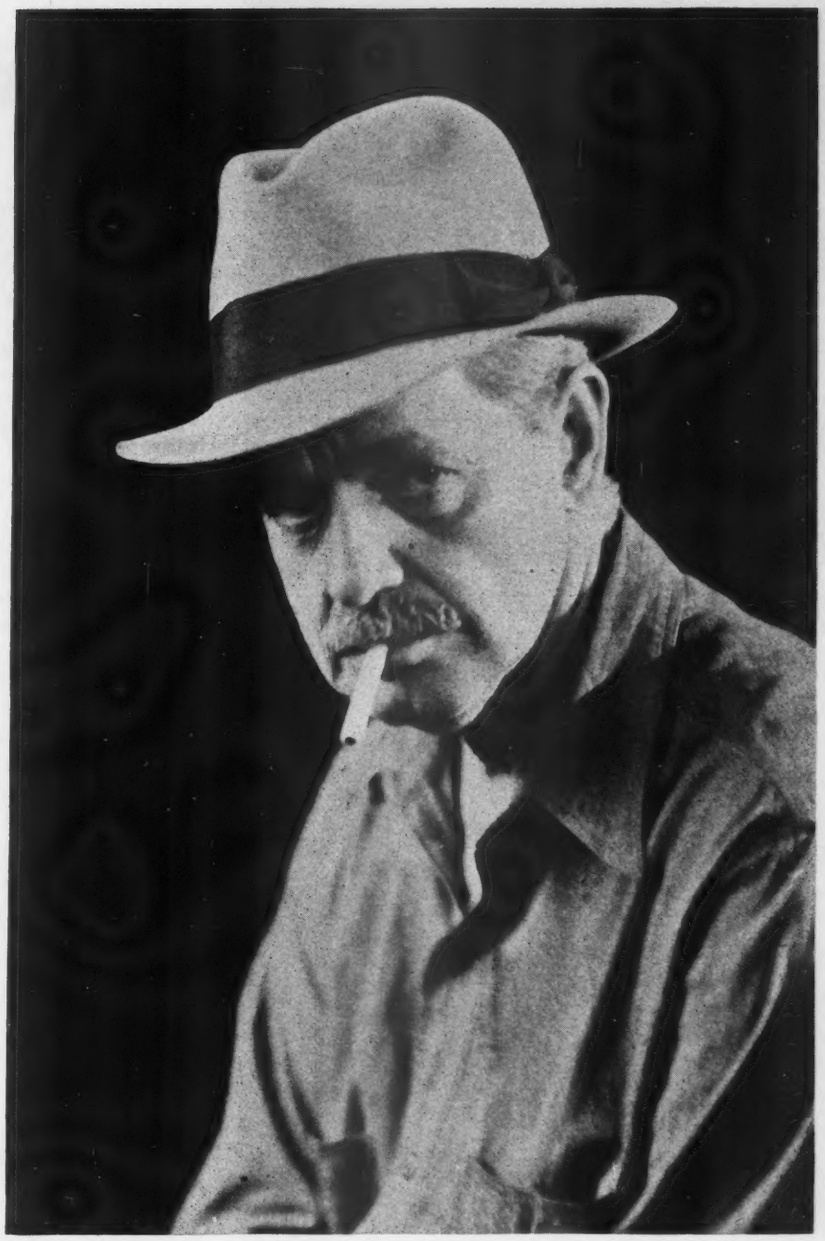
What is worth noting right here is what the direct beneficiaries of WPA know better than others—namely, that almost a year and a half ago the plan's cash benefits and general dependability were considerably decreased and its various restrictions greatly increased—its all-round attractiveness much lessened. Also, since the more recent "persecutions" of Communist Candidate for President, Earl Browder, the Workers Alliance or WPA union has followed its radical leaders into open enmity against the plan's authors and administrators. It is, accordingly, a great mistake to assume that all WPA beneficiaries will vote the same ticket. Much the same can be said of reliefers generally.

It is also worth noting that, thanks to the personal experience of the wage earner or his friends and neighbors, workers generally believe that the greatest of the country's problems, next to the nation's defense, is represented by the present millions of unemployed.

If only the individual's long-term employment and security could be tackled as directly, as simply, and as hopefully as the nation's quick preparedness! To be sure, both have been generally assumed to require comparatively little besides federal money, lots of federal money. But this has, to date, hardly availed to put men to work—and few workers, rightly or wrongly, expect even the war boom to do it as fully as could be hoped.

Is it any wonder that the worker is puzzled, full of questions, afraid of political oratory, anxious for light? He would like to risk a change—a new approach: Perhaps Business *could* solve this second-biggest problem if given a better chance. But for every wage earner who thinks the gain worth the risk there is likely to be at least one who has no idea what causes unemployment (unless it be the machine) and who fears the loss of such security as he has. So a surprising number of those who are unhappy in their present bare-subsistence jobs, whether public or private, are willing to take the risk, with a surprising number of their better employed friends

(Continued on page 142)



Whiting Williams knows "what's on the worker's mind." He knows because every so often he changes his name, puts on overalls, becomes a laborer in America's mills and factories. Throughout his researches, in his work as industrial consultant, author, and lecturer, Mr. Williams aims always to exert the helpfulness of the unbiased observer. As consulting editor of FACTORY, his recent contributions include "My One-Man Poll of Worker Opinion," (Dec., 1939), "Every Day Is Voting Day in the Plant," (June, 1940). Above, Mr. Williams in worker disguise

Cases in Work

For catch-as-catch-can methods, work simplification substitutes the rhythmic ease of simultaneous two-hand or alternate left- and right-hand operation

JAMES J. BAER

Industrial Engineer

Rubberset Company, Newark, N. J.

NOT ABOUT BRASSIERES, I warned in the opening sentence of a previous article in FACTORY (Feb., 1939).

Not about brushes, I say here.

I say it in case someone expects me to reveal the secrets of this venerable concern which has been making fine brushes in this self-same location for 67 years.

No, the only secrets I have any interest in revealing are the "secrets" of work simplification, which work equally well in the manufacture of cookies, lead pencils, brassieres, brushes, or what have you.

That is all I want to prove here. But to do so I can't take FACTORY readers on a personally conducted tour of the Rubberset plant. Instead I must resort to photographs of a half-dozen unrelated operations. In the text that accompanies each picture I shall try to show how much easier we have made it for the operator to turn out more work for the company and at the same time put more dollars into the weekly envelope.

1 **GUMMING. Idea is to impregnate newly made brushes with a solution that leaves bristles stiff when it dries, thus protecting them in later operations. *Old way*—as practised since 1873—was to heat a tubful of solution. Operators were men who dipped one-handed. No heat control. As the stuff cooled, it thickened and formed a scum. *New way* is to heat mixture under thermostatic control and pump it to small tanks sunk into work benches. Girls pick two brushes from tray with left hand, shift one to right, dip both at once, pass them across dividing bar to remove excess liquid. Brush in left hand is then shifted to right which moves brushes to tray while left picks up next pair to be dipped. Operator soon develops easy rhythmic motion. She sits or stands, as she pleases. No heavy pots to handle. Temperature always right. Circulation of mixture prevents scumming over**

2 **SIZING. Idea is to push bristles out of ferrule to make brush right length. Done with simple gage that pushes so far and no farther. *Old way* was to use single gage, not fastened to bench. Left hand did nothing but hold. *New way* employs two gages fixed to bench. Left hand picks two brushes from tray (tilted at convenient angle), shifts one to right hand. Brushes are then pressed down on gages, two at a time, bristles being thereby pushed out of ferrules to required length. Brush in left hand is then moved to right which replaces brushes in tray, while left hand picks up next two. Gages for various sizes are changed in a second with just a couple of turns on a knurled nut**

Simplification

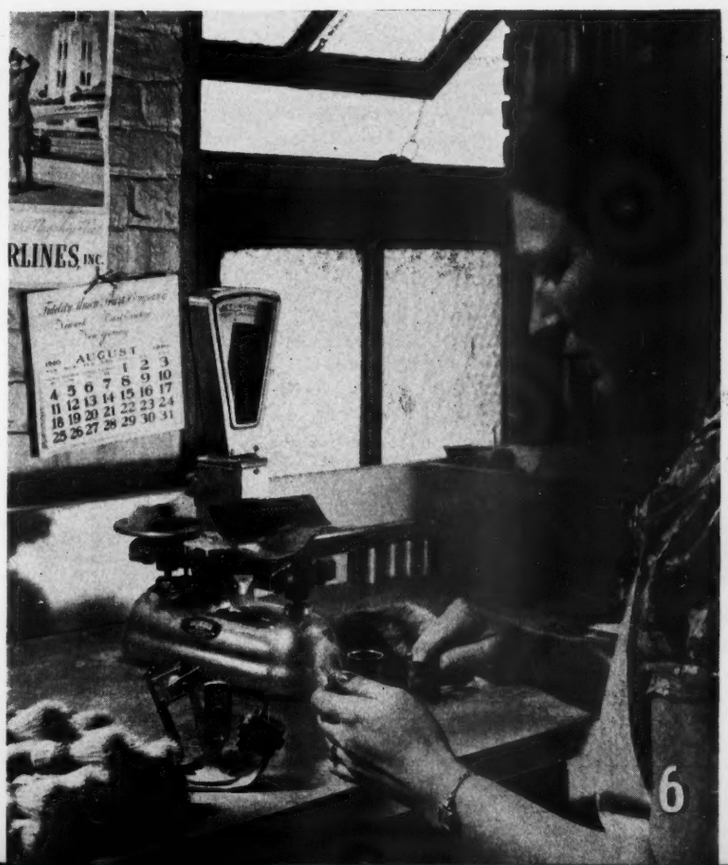
3 STAMPING. For identification marks on handles, such as trade names, stock numbers, sizes. *Old way* was to stamp brushes the last thing. If something went sour, whole brush had to be reworked. Also, it was a one-hand, one-at-a-time operation. *New way* uses alternate left- and right-hand motions. Two sources of supply, one on each side of press. Left hand places handle in position as right picks up another. Handle is ejected by mechanical kicker into drop delivery chute leading to tote box on floor. If anything goes wrong, only a handle is spoiled

4 HANDLING. This picture shows *old way* of assembling brush to handles. Left hand held bunch of handles. Right picked up brush by ferrule, placed it over handle; removed handle from left hand, struck it on metal block, thus driving handle home. In this motion, right hand slipped down ferrule to handle, then tossed brush into tray (not shown). Tray then carried to punch where three separate operations prick-punched ferrule to handle. *New way* (shown in next photograph, but with a different brush that is nailed instead of prick-punched) permits handling and prick-punching in one operation

4

5 HANDLING. Here is the *new way* of assembling brush to handle. Right hand picks up handle; left, brush. Handle and brush are moved to fixture with simultaneous motions. Operator steps on pedal, which causes teeth to come up through holes in plate. Teeth hold brush in place. At same time the part of the fixture that is partially concealed by right hand moves to force handle into ferrule. Pedal is released, teeth drop down, left hand slides assembled brush to drop delivery as it moves to pick up next brush to be assembled to its handle

5



6

6 LATHER BRUSH MAKING. See the gadget on the bench. It's a big help. Operator weighs out right amount of bristle, "flags" bundle against bench to remove loose stock, then "cups" bristles to give them right rounded shape. Now she ties the bundle. String is threaded through small trigger which in down position holds string taut, in up position allows it to be pulled through freely. When bundle is tied, operator with single motion trips trigger of counter (at left of gadget), at same time carrying string down to razor blade (on center post) which cuts it. Left hand continues motion to drop brush on pile of finished work

Each Order Dictates Its Own Layout

When cost of moving equipment is less than the cost of trucking parts to presses in many scattered locations, presses are moved and lined up for straight-line flow

FRANK E. GRAPER
President and General Manager
The Acklin Stamping Company
Toledo

OUR BUSINESS is distinctly a jobbing or contract type of manufacturing; orders depend upon customers' specifications, and are for a few up to a million or more pieces, both large and small. In order to meet this varied demand, our press layout is changed frequently to handle the orders most effectively. Depending upon orders, some weeks may see no change in the press layout; in others from 15 to 20 moves may be made. These changes may involve one press only, or may consist of moving a line of several presses into position to secure sequential flow of parts from the blanking operation to the shipping container.

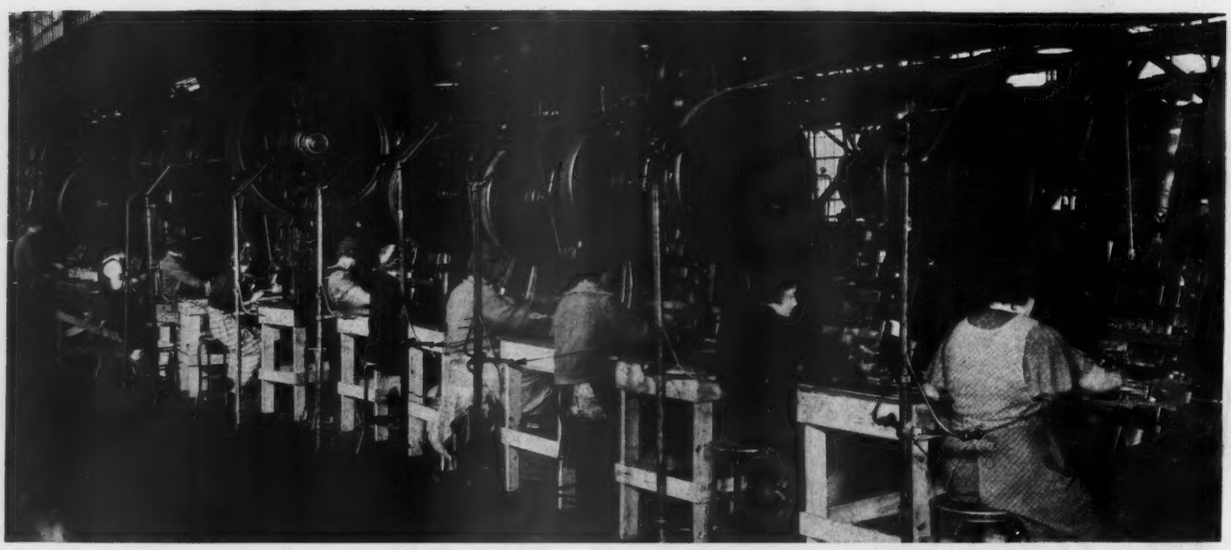
In general, it may be said that we move presses, change the layout, when it is estimated that the cost of such moving is less than the cost of handling between operations, were the parts trucked about the shop to presses in scattered positions. An order for 2,000 of the larger pieces, and sometimes for even a smaller number, results in a shifting of presses into positions corresponding to production sequence.

This flexibility not only reduces handling costs and speeds up production, but tryout and inspection are also facilitated; quality proof is made by piece rather than by batch. Within five minutes after starting a piece in a sequential line we can tell if, and what, changes should be made to meet specifications, or to eliminate manufacturing difficulties. Batch proof is more difficult and more likely to result in scrap when operations have to be changed.

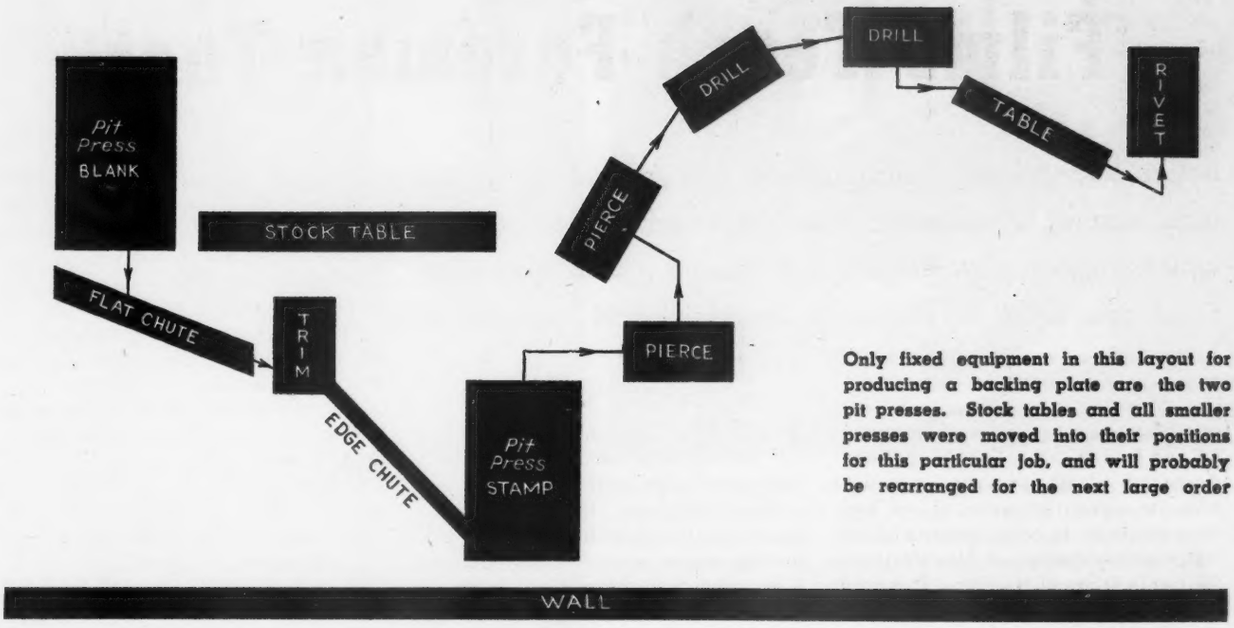
The shop is divided into a high bay, in which a 10-ton crane operates, and two low bays. In the former are located several pit presses, such as 1,000-ton mechanical and 400-ton hydraulic, which are, of course, not moved to accommodate the shifting character of the orders. But this does not prevent moving smaller presses and supplementary equipment, such as drill presses and riveters, into position about those fixed presses, to avoid trucking parts about the plant. The layout chart indicates how movable equipment was grouped about two pit presses at the time this article was written. When this order was completed an entirely new layout could be made by shifting the supplementary equipment for the next order. Since a crane operates in this high bay, movable equipment auxiliary to the pit presses is driven by individual motors.

The use of lineshafting does not rule out a frequent shift in layout. In one low bay, two rows of lineshafting extend the length of the shop, one adjacent to the aisleway and the other to the high bay. Each of these lines of shafting is broken up into sections, and each section is driven by a motor, again for greater flexibility. Each press is attached to the line by a split pulley; moving consequently involves unbolting the pulley, shifting it to a new location, and adjusting the length of the belt. Incidentally, moving the pulley to the new location on the shaft is the most difficult part of shifting the layout.

We are limited, of course, in the weight that can be moved because the overhead crane is of 10-ton capacity. This crane was designed to facilitate frequent shifting in layout; a carriage for an operator would require head-



Small presses in this line of machines working on a cover plate were dragged into position with the help of a tractor. The medium-sized presses at left were lifted into position with the crane by means of U-bolts attached to upper part of the frames



Only fixed equipment in this layout for producing a backing plate are the two pit presses. Stock tables and all smaller presses were moved into their positions for this particular job, and will probably be rearranged for the next large order

room along the craneway, and this would unduly restrict the placing of the larger movable presses. It is operated from the floor, by means of a push-button panel which places no limitation upon the location of the presses.

Two methods of shifting presses are used. Small open-gap presses from 20 to 30 tons are moved by hooking a chain around the base and pulling them into position with a tractor. This is readily done as the floors are wood block on wire-reinforced concrete base. Somewhat larger presses, from 40 to 100 tons, have U-bolts attached to the upper part of the frame. The crane hook engages this and the press is quickly moved to its new location. The photograph shows a row of ten medium and small presses all working upon a cover plate. The first six presses, all small, were dragged into position by the tractor. The seventh, a larger press, has the U-bolt visible above the flywheel; this was moved into position by the crane. The crane was used in this case because the high center of gravity might cause the press to tip were it dragged over the floor. Safety guards are shifted with the presses into the new locations.

Moving time varies somewhat with the size of press and the distance to be moved. However, one-half hour is a fair statement of the time required to move, to make the pulley adjustment, and to fasten the press down with lag screws. The operators shown in the picture are working upon an order of 50,000 cover plates. These presses were lined up ready to operate in five hours' time. The next order may require that this line be scattered to different locations to form other sequential combinations.

It should be pointed out, however, that a line of presses may not be shifted for the next order if that order is for a closely similar part. Die inserts may be used, some dies may be shifted, or operations may be added or dropped. This is done where feasible, and the moving time is thereby reduced.

Most of our attention in this article has been devoted to press shifting. A great deal of welding has to be done, depending upon the customer's specification and the method of manufacture decided upon. It has been mentioned that a welder is frequently placed in proper location in a line of presses to secure sequential flow of parts. The requirements may go beyond this; we may need a line of spot welders in sequence to finish a part without running two parts on the same welder, with the attendant part handling. Electrical and water connections are provided so that shifting of this equipment may be and is done just as readily as with the presses.

There are many advantages in making layout as flexible as it is in our plant. For one thing, valuable floor space is not taken up with boxes of partially completed parts; this means, of course, that the investment in work-in-process for a given output is much less. Scheduling is greatly facilitated. The manufacturing order is run out and the minute details involved in scheduling and moving parts to individual presses are eliminated. This means, too, that the time required is shortened and service to our customers is definitely and considerably improved.

"WHAT INDUSTRY CAN DO FOR AMERICA" IN POSTERS, FILM, AND PAMPHLETS

To facilitate wide dissemination of the story of what industry can do for America, as published in its August issue, FACTORY has arranged for reproduction in poster, sound-slide film, and pamphlet form.

Posters, in color, are being produced and sold by Graphic Chart Service, 2-140 General Motors Bldg., Detroit.

The sound-slide film is being distributed by Eugene J. Benge, 20 North Wacker Drive, Chicago.

Pamphlets, ten in number, are being sold by the Sheldon-Claire Company, 520 North Michigan Ave., Chicago.

Films Teach Foremen Tact

Better supervisory relationships are bound to result from use of sound-slide films in foreman conferences which take on new life when dramatic picture presentations are used to stimulate thinking and discussions

SOUND-SLIDE FILMS make foremen sit up and take notice. That is the experience of plant operation executives who are using the series of six such films prepared in consultation with the National Association of Manufacturers for use in foreman training. It is from *The Reprimand*, one of those six films, that the pictures on these pages have been chosen. They are reproduced here to illustrate this newest technique in the bettering of human relationships in industry.

These 15-min. films provide a welcome change from the conventional group conferences and lectures, are thus practically guaranteed to put new life into training programs. By dramatizing the situations met daily by every type of foreman; by clarifying the relationships of these men with each other, with their supervisors, and with subordinates, they serve as a springboard from which to plunge into the discussion phases of any meeting.

In order that the pictures might be representative of all industry and applicable to all plants, NAM members were queried as to their interest before the series was launched. They cooperated to provide case examples from which scenarios were prepared. Before release, the films were exposed to the criticism of several supervisory groups whose criticisms were incorporated in the final "field tested" films now available. That the results smack thoroughly of the shops is therefore no surprise.

Although the six films—*The Foreman as an Executive, The Foreman as a Teacher, The Foreman as a Leader, Letting Men Know Where They Stand, The Reprimand,* and *Handling the Grievance*—form a series or course in major phases of human relations from the supervisory angle, they need not necessarily be used in any particular order. They may be fitted into whatever type of supervisory training program a given plant has in operation; they may be used for intensive discussion groups or for more casual meetings. Although the titles are specific, much ground is covered.

Availability of this dramatic approach to supervisory training is expected to supply the impetus to many companies that have contemplated launching training programs but which have hesitated for lack of material. Therefore, a working outline has been prepared showing how to adapt and use the films, including plans for developing conferences, suggestions for conducting meetings on each of the six topics, bibliographies of other supervisory training methods.

EVERY SUPERVISOR knows, from personal experience, what the wrong kind of reprimand from a traffic cop can do to his nerves, attitudes, and spirit of cooperation. The film opens with the familiar reprimand of the traffic cop, which is not always an example of tact

AL MILLER, foreman of a repair department, doesn't seem to hit it off right with his men because of the way his reprimands are taken. When he mentioned the matter to Steve Marcum, employment supervisor, Steve made what to Al seemed a queer observation: "Men's traits deserve as careful study as instruments of production." The analogy set Al thinking

AL SOON FACES the task of reprimanding Jim Kosack. Jim has broken a rule about holding a temperature by hand, and $48 in labor has been wasted. Al has learned his lesson of the public reprimand which kicks back like a boomerang. So he asks Jim to step over to a quiet spot where there will be no audience

TALKING STRAIGHT without getting mad, enforcing the rules without breaking men's spirit—these are two of the sound principles of the reprimand which Al is learning are important for him to watch for. He works along sound lines with violator Jim, and comes through the ticklish session with considerable success

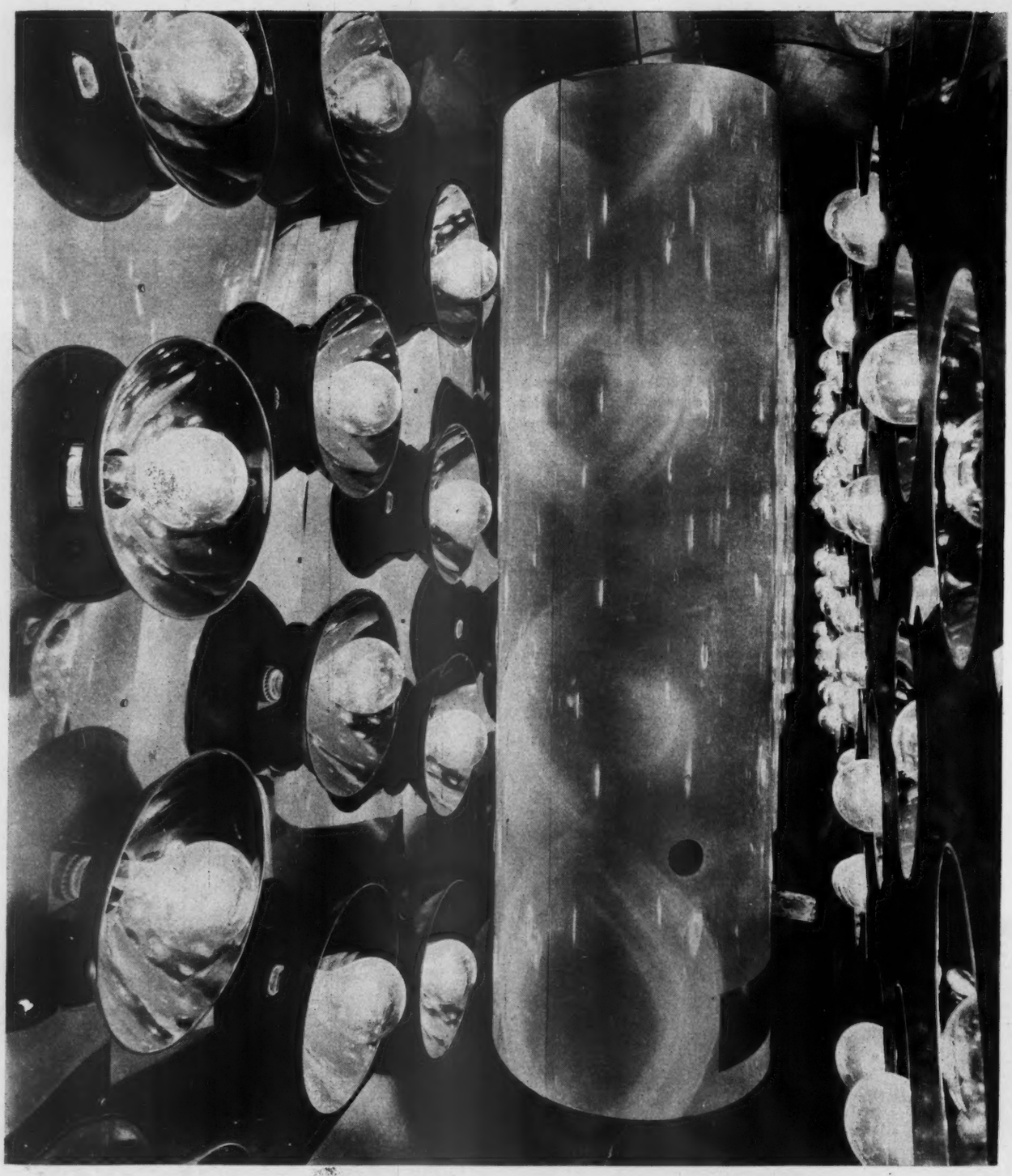
AS HE CONTINUES his study of the problem, Al finds his best answers through check-ups with the experiences of other practical men. Phil Cross emphasizes a point for Al's list: "By all means keep cool. Yesterday I let a half day go by before I went after Guy Deaks for breaking a cable which meant six weeks on hand control for our department." Another note for Al's book

HIS NOTEBOOK is his route to safety, Al has come to think. He is getting the points down in one, two, three order, so that no distraction may allow him to forget. Harry Lake adds the advice: "Al, it's one thing to make a list; another to use it"

Enameling in Nine Minutes With

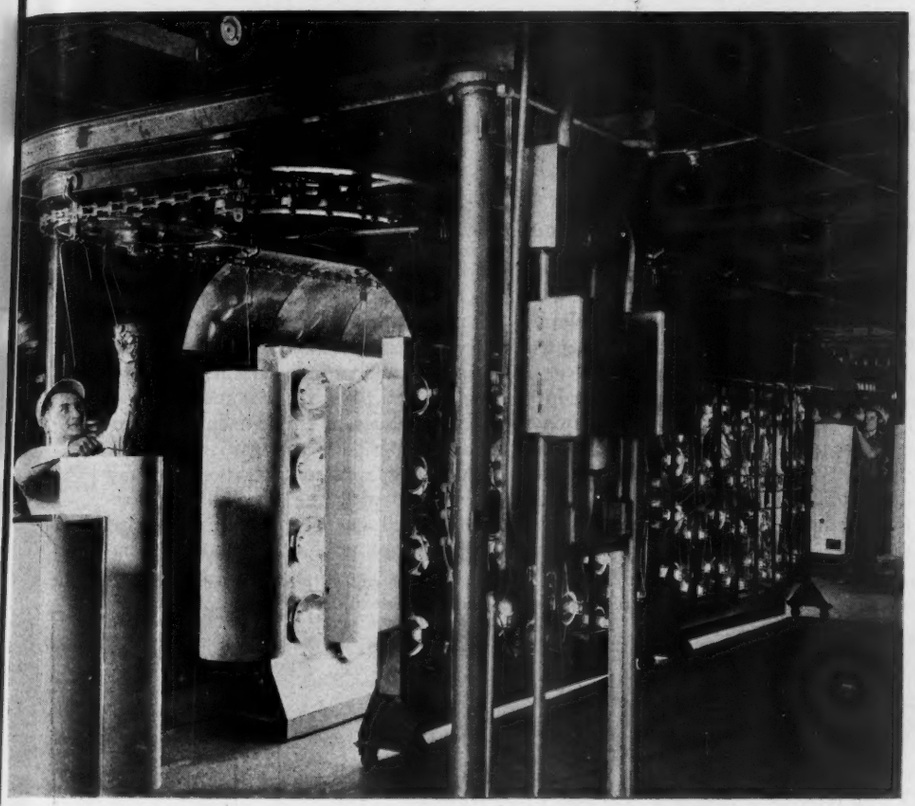
Air-drying took too much time, too much space. Baking with infra-red lamps gives better finish, saves storing and handling, cuts rejects, improves customer service

W. A. HOWE
Methods Engineer
Lawson Manufacturing Company
Pittsburgh



All lamps go full tilt to dry jackets, but for small parts some of the lamps are turned off, or else the conveyor is speeded up

Infra-Red Lamps



With the conveyor moving through the 18-ft. drying oven at a speed of 3 feet per minute, it ordinarily takes just 6 minutes to dry hot-water heater jackets completely

SPACE IN OUR PLANT, as in so many others, was at a premium, and the problem of baking enamel on hot-water heaters loomed large. Should new gas or electrically heated ovens be installed, and if so, where? Wouldn't this take additional help and possibly slow down the assembly lines? Wouldn't unit costs go up?

Infra-red lamps answered all this and more. Their installation has straightlined the paint shop, reduced the number of rejected paint jobs, made rush shipments of specially colored heaters a matter-of-fact operation, and actually reduced painting costs over the air-dry method.

Under our old set-up, to air-dry sufficient jackets for one day's assembly required too much space. While the painted jackets required for each day were drying, part of the following day's run would have to be painted. In a restricted area the congestion became more acute as demands for more heaters were placed on the assembly lines. Either overtime would be necessary or production would lag—either way was expensive. For a short period, a small gas oven was used to bake the enamel on heater tops only, but this necessitated so much handling and delay that to perform the same operation on a larger scale would have been prohibitive.

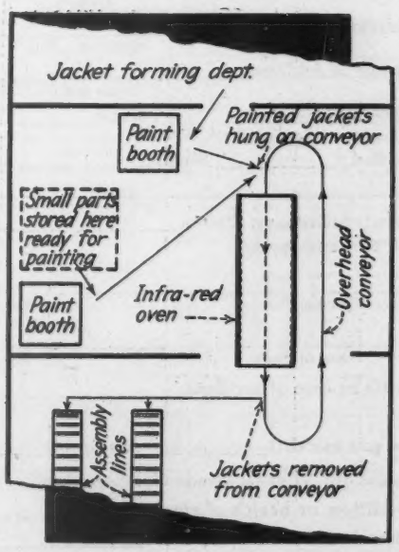
The plan view of the paint shop after installation of the infra-red oven is shown in the sketch. Now an unpainted jacket enters the paint shop, receives its coat of paint, and is delivered by the overhead conveyor through the oven to the assembly line, baked hard and dry ready for assembly 9 minutes later. The conveyor, moving at a speed of 3 feet per minute through the 18-ft. delivers one jacket per minute, or a maximum capacity of 60 jackets per hour. If requirements exceed the oven capacity at some future time, the capacity could be increased by merely adding additional lights to the end of the oven and increasing the conveyor speed. An increase in demand of 25 percent would require approximately 6 feet additional to the end of the oven and an increase in conveyor speed to 4 feet per minute.

The operation of the oven is flexible in that it permits several combinations of speeds and series of lights to be used, depending upon demands. While use of infra-red drying lamps is comparatively new and much is to be learned by experimenting, it has been determined that a coverage of approximately 15 square feet on 20- to 24-gage metal will bake hard and dry in approximately 6 minutes. Where the metal mass or gage is heavier, proportionately longer drying time is necessary. Although an even distribution of rays is played on the painted surface, regardless of its size, it has been found that a piece of 20-gage metal 1 foot square will bake much faster than will a piece of the same gage 10 square feet in area.

Less Heat on Small Parts

This fact has much to do with the economical operation of the oven. When baking small jackets with an area of approximately 2 square feet, 75 percent of the lights can be turned off by switches conveniently located at the entrance to the oven. The remaining lights are sufficient to bake the small jackets without adjusting the conveyor speed. Should a large number of small jackets be needed in the shortest time possible, only 50 percent of the lights would be turned off, but the conveyor speed would be increased to approximately 5 feet per minute.

As the various combinations of lights and conveyor speeds are determined for various gages and sizes, they are recorded and posted in a convenient location near the switches and conveyor controls to insure uniformity of the product, and controlled cost.



Space occupied by infra-red oven was formerly given over to storage of heater jackets and parts while they air-dried. New layout ended congestion

One Form for Personnel Records

With the first confusion of setting up social security procedures over, it's time to consolidate records — into a single form like the one described here, if possible

J. E. WALTERS

Director of Personnel, School of Engineering, Professor of Personnel Administration, Purdue University

SOCIAL SECURITY has brought need for changes in most companies' personnel records. In the past, many small companies have not kept adequate records to provide information for the government as well as proper data for employees. But these companies can maintain a good simplified personnel record for each employee without much expense, by combining the various essential personnel records into one form. Of course, such a form must be adapted to the individual company.

It is a common and wise procedure to require every applicant for employment to fill out an application blank upon which he or she gives personnel information about himself, and any falsification of which can be justification for dismissal. Upon acceptance of the applicant for employment, additional social security and unemployment insurance information is a first requisite. Space for recording subsequent changes in employment and records of periodic ratings is essential. Finally, separations from the company do occur, with the possibility of rehiring. All of these data are needed from day of application until the em-

Front side of the Employee's Personnel Record, which is filled in by the prospective employee, serves as the application blank

EMPLOYEE'S PERSONNEL RECORD

Company Employee Clock Number_____

Social Security Number or
Date of Application for it_____

Name_____
Employee's First Name Middle Name Last Name
Married Women: Give maiden first name, maiden last name, and husband's last name

Date and Place of Birth_____
Month Day Year Place of Birth

Address_____
Street and No. Post Office State Phone No.

Change of Address_____
Street and No. Post Office State Phone No.

Sex: Male_____ Female_____ Color: White_____ Negro_____ Religion_____
Check X which Check X which

Married_____ Single_____ Dependents: Give names, ages, relationship_____

Parents full names: Father_____ Mother_____

Last two employers:

☐
Name of Firm Kind of Work Date started and left Reason for leaving

☐
Name of Firm Kind of Work Date started and left Reason for leaving

Notify in case of accident:_____
NAME AND ADDRESS RELATIONSHIP TO EMPLOYEE TELEPHONE NO.

Are you in debt?_____ Amount $_____ What Life Insurance $_____

Education: Highest Grade Completed_____ Name and Address of School_____ ☐

Condition or health of employee:_____

When last treated by a doctor_____ For What_____

Doctor's name and Address_____ Telephone_____ ☐

Any sickness in employee's family?_____ What_____

Do you have any relatives employed in this Company?_____ Who_____

Temporary?_____ Permanent?_____

Signature of Applicant_____ Date_____ 194____

ployee leaves the company for good.

With this in view, the author worked out for a group of 35 companies a personnel record which would combine into one record the application blank, social security, unemployment insurance, and other personnel information. This resulted in the personnel record shown here.

It Pays to Check

The face of this record is an application blank which the applicant fills in. This contains the personal and personal history information, the names of applicant's last two employers, condition of his health and name of his doctor, education, and other material. To the right of the names of employers, education, and health data are small squares where the employer can check after he has investigated the records. A company can verify the truth of the statements given and the caliber of the work performed with but little expense. In one city, an employee was hired and fired by eight companies in one year; a call on the previous employer by any of the last six employers would have prevented that waste of time and effort in employing and training that employee over and over again. Telephone or personal calls to previous employers, schools, or the doctor may save the company from employing an inefficient or unhealthy applicant.

The reverse side of the blank contains information about the applicant after he has been hired. Subsequent changes in employment within the company are placed in the center, as are periodic ratings of the employee. At the bottom are the employee's tax or unemployment insurance status plus dismissal and rehiring information.

This record exemplifies that personnel records can be simplified by combining application blank information, information required for social security and unemployment insurance, the continuous personnel record, and that concerning discharge and rehiring.

Time to Simplify

Many companies have simplified their financial accounting procedures. Likewise, the time is ripe for a simplification of personnel accounting procedures —to decrease expense to the company as well as to encourage the employee to greater achievement. Most good workers seem to want to know that what they do accomplish is known and is made a matter of record. We want more good employees. This warrants the maintenance of a personnel record for each employee, which naturally involves some cost to the company. Therefore, a simplified or combined record may prove to be the most economical.

Reverse side of the personnel record, filled in by personnel department after applicant has been hired, holds information necessary for social security and unemployment insurance, as well as employee's record of accomplishment and service with the company

EMPLOYEE WILL NOT FILL IN THIS SIDE OF RECORD

Date Employed:_____ Type or kind of work_____

Rate $_____ Per_____ Overtime $_____ Per_____ Steady_____ Temporary_____ Full Time_____

Date Becomes 65_____ Years in State_____ Nationality_____
IF CITIZEN, STATE AMERICAN

Employment contract made in State of_____ Work done in State of_____ Work done in District_____

Full time weekly hours_____ Nature and value of other compensation_____

CHANGES IN EMPLOYMENT IN THE COMPANY

DATE	RATE	DEPT.	REMARKS

RECORD OF RATINGS

TRAITS			

Remarks _____

Absences and Late Record_____, _____, _____

Tax Status: State unemployment Insurance_____ Federal old age Security_____

Reasons for exemptions?_____

Date dismissed or left Company_____ Discharged____ Laid Off____ Quit____ Reasons_____
CHECK WHICH

Status for rehiring: Rehire_____ Do not rehire_____
CONDITIONS REASONS

_____ Dept_____ Date_____
SIGNATURE OF FOREMAN OR SUPT.

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

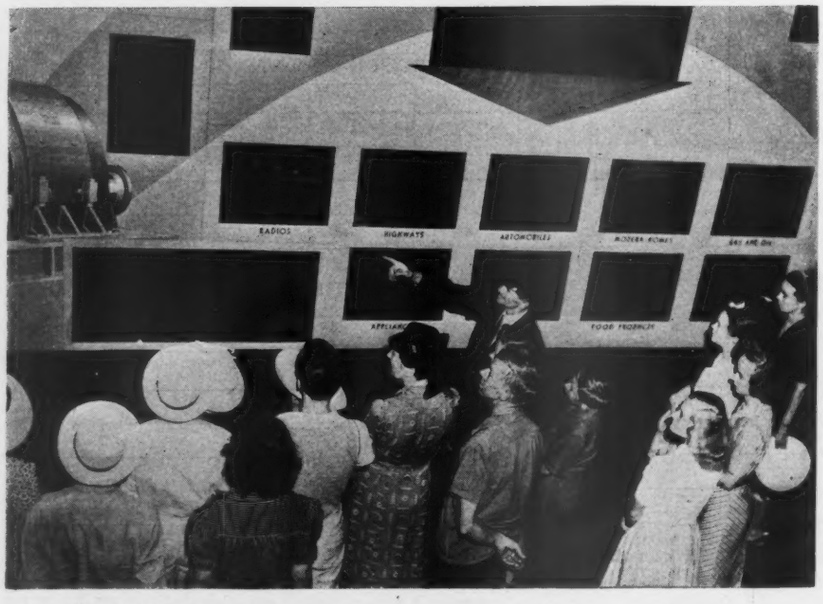
EMPLOYEE RELATIONS AND SAFETY

Illustrated Signboard Helps Guide and Visitors

SOURCE
General Electric Company
Schenectady, N. Y.

For years the visitors' guides in our Schenectady plant have been forced to raise their voices to a shout while conducting visitors through the huge motor and generator shop, trying to explain above the din of work the operations taking place there. This fact alone kept explanations to a minimum, and many visitors, unable to catch the words, have gone away with only a vague idea of the significance of what they have seen.

But the erection of a 13 x 24-ft., all-color, illustrative signboard in the shop entrance has changed all that. Now, in the comparative quiet of the building entrance a guide points out and explains, through the use of the large photographs on the board, just what the sightseer may expect to see within the next few minutes. Then, with the foreknowledge gained from the photographs and the guide's talk, visitors are escorted to the gallery of the huge shop, where they obtain a good understanding of how large electric motors and generators are built, and put to work in factories all over the country.



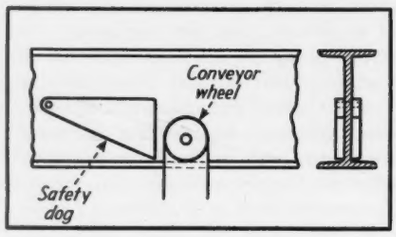
The signboard, only one-fourth of which shows here, helps the guide tell the story

•

Safety Dog Keeps Broken Overhead Conveyor From Falling

R. A. SHAW
The Murray Corporation of America
Detroit

An inexpensive safety dog or drop catch that drops behind each wheel of a chain conveyor saves a great deal of time if the chain breaks. In the event of a break, it catches the wheel that has just passed and prevents the conveyor from rolling back along its mounting. This saves a great deal of time that might be needed to pull broken chain together.



This device is particularly valuable on inclines, for it prevents the chain from falling down to the low point and dropping parts on men below.

To some of the drop catches electric contacts are attached. If the chain breaks and the safety dog functions, these contacts shut off power driving the conveyor.

•

Goggle Service Man Is Safety Inspector, Too

SOURCE
Caterpillar Tractor Company
Peoria, Ill.

Men who lost their goggles or broke or bent them used to have to go to the safety division office for replacements and repairs. Those men who require respirators and welding helmets had to make the same long trek.

Five years ago the safety and sanitation engineer, talking things over with the management, decided that if it is good production planning to bring the work to the man, the same principle applies to safety equipment. So, in conjunction with the production department, a rubber-tired, hand-push truck was designed for the use of a safety division man who toured the plant departments in the interests of well-maintained goggles, respirators, and helmets.

The idea worked out so well that now there are two carts, and four men

There's no procrastination over goggle repairs when repairman comes to the goggles

to keep them moving during all shifts. The attendant makes about 125 contacts daily. He cleans, repairs, and readjusts safety goggles, and inspects and adjusts respirator parts and welding helmets.

In the five years this practice has been in effect, the attendant's responsibilities have been broadened to include a general safety inspection. As he moves through the working departments, he is supposed to keep his eyes open for anything of hazardous nature and report it to the safety engineer. He also has the duty of double-checking on accidents that have happened since his last visit to a department. He often is able to find witnesses who could not be reached following the accident, because a shift changed. In brief, besides servicing goggles, respirators, and helmets he acts as a general utility man constantly on the move in the interests of safety.

•

Every Foreman Is Becoming a Public Speaker

L. G. JACQUES, *Works Manager*
Motor Products Corporation
Detroit

I suppose it is general experience that when a meeting is called to consider operating problems one or two supervisors do a large part of the talking; the rest listen. This is especially true with foremen. When these men get back to the familiar surroundings of their departments they have lots of ideas which, were they expressed in meeting, would aid in developing group thinking toward helpful solutions.

Stage fright is not necessarily an inherited aptitude, so we determined to do something about it: To develop in our foremen an ability and willingness to speak out in meeting and contribute their ideas to the solution of company problems.

Two public speaking classes of 20 foremen each were begun and continued through 12 weeks with one session of an hour and a half each week. A teacher of public speaking was secured to conduct these classes. Attendance of the foremen was not compulsory; however, 70 percent freely volunteered when notice of the classes was posted on the bulletin boards.

In March, when the sessions began, classes were held on Saturday morning when the plant was not in operation. But when the weather got better and weekend trips became important, the classes were shifted to working day afternoons on company time.

Proof of the pudding is in the eating of it, and we have had sufficient proof that the cost of some $200 has been returned manyfold. In the first place our foremen have caught the spirit of self improvement—they do a better job. Just the other day, one of our men presented a coordinated plan for handling material, which would save a lot of money in a comparatively short period of time; he would have been unable

Management, How Good Is Your Control?

Ask yourself these questions to check up

2. SETTING UP MACHINES

1. Have men been provided with a standard setting-up procedure? In writing?
2. Have men been re-instructed in such a standard setting-up procedure?
3. Are frequent checks made to see that they are closely following it?
4. Are setting-up tools and assembling tools effectively prepositioned?
5. Is equipment effectively prepositioned?
6. Are charts provided for general guide in setting-up procedure? Are they easily read? Conveniently located? Simple? Kept up to date?
7. Are tools returned to proper preposition after setting up?
8. Can standard setting-up procedure be improved in any way? Can any step be eliminated, recombined or altered to reduce setting-up time?
9. Is community equipment easily accessible? Readily identified? Kept clean? How often should it be cleaned? How should it be cleaned?
10. Is setting up synchronized with feeding of work to operator?
11. Does operator have to clean parts or machine? Why? Is testing during initial setting up standardized? Is operator familiar with set-up?
12. Is operating procedure standardized? Is operator trained in setting up?
13. Is work stand cleaned up and prepared for next job, as one of the steps in the standard setting-up procedure?
14. What provision is made for keeping small parts and supplies properly available? Is supply kept ahead of demand?
15. What provision is made for changing over to next job?

Next Month: Production Standards

Prepared by HARDING PALMER, *Industrial Engineer*
Lockheed Aircraft Corporation, Burbank, Calif.

to overcome his reticence, and the plan consequently would not have been presented, had he not had this public speaking training. Some of our foremen were involved in a labor board hearing; in this situation also their training enabled them to present their side of the case in creditable fashion.

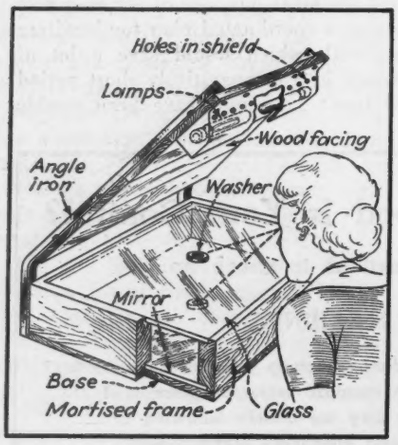
At a recent bowling banquet there was a delay of an hour and a half in the appearance of a scheduled show; three or four of these public speaking foremen ad libed for the entertainment of the 135 supervisors present. On the more serious side of company business, this program has proved worth while. When these men are now in meetings they are not afraid to express their ideas; some have developed into good speakers. Results have been so worth while, in fact, that the program will be extended during the coming winter.

PRODUCTION METHODS AND MATERIALS

Washer's Two Sides Inspected at Once

J. A. HONEGGER, *Bloomfield, N. J.*

We recently had to inspect, on a quantity production basis, several hundred thousand fiber washers that had been slotted on both sides. To inspect one side and then turn each washer over to inspect the other side was



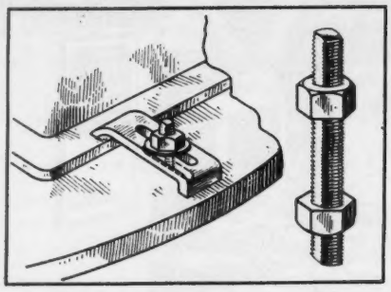
a time-consuming method, especially since the washer's small dimensions—one hundredth of an inch thick and three eighths of an inch outside diameter—made it difficult to handle.

To speed up the inspection, we constructed a device incorporating a mirror, which enabled the inspector to see both sides of the washer at once.

A wooden frame 18 inches square was mortised out on both top and bottom edges. Into the lower mortised section a plate glass mirror was snugly fitted. In the upper mortised section, a piece of plate glass was fitted. To the back of the frame two pieces of angle iron, shaped as indicated in the sketch, were bolted. Then to the undersides of these angles a board facing was bolted and given several coats of white enamel. At the top of the fixture, and mounted to the board facing, two tubular electric lamps were installed behind a metal shield. Holes were provided in the metal shield for dissipating the heat given off by the lamps. A base was attached on the bottom of the fixture to prevent scratching of the silvered side of the mirror.

In operation, the inspector threw a handful of washers on the glass, and separated them by spreading them out. She would then glance at the tops of the washers and pick out all those that were not properly slotted. Then she would shift her eyes and look in the mirror, where the lower face of the washers would be reflected. As the distance between the under side of the plate glass and the top of the mirror was some two inches, the images were positioned far enough apart that the inspector did not confuse the under side of the washer with the top side. As the white of the board facing was reflected in the mirror, and the washers were black, sufficient contrast was obtained for distinct outline.

•



Lathe Faceplate Bolts That Won't Turn

CHAS. H. WILLEY, *Penacook, N. H.*

For quick set-up of work that must be strapped to a lathe faceplate, the non-turning bolt shown in the sketch will be found very handy. It keeps the straps from swinging out of line.

The bolt is made by milling two flat sides on an ordinary bolt. It is milled to fit slots of the clamp and faceplate. Designed for repeat work, it has proved useful for much other work as well.

Flaw detection is made easier and more certain with a portable X-ray machine that is wheeled along production lines at Westinghouse Electric & Manufacturing Company's plant in East Pittsburgh, spotting flaws in welds and castings. This machine, shown here focusing on a tank weld, generates X-rays that penetrate three inches of steel

MAINTENANCE SERVICES

SELECTION

INSTALLATION

INSPECTION

UPKEEP

ORGANIZATION

OCTOBER, 1940, CONTENTS

Editorials 72

Motor Troubles I Have Met ..... *Lionel A. Hunt* 73

Stop Vibration, Add to Lamp Life ..... *James D. Hall* 75

Instruments Pay Us a Good Profit ..... *Charles E. Armstrong* 78

Into Every Ear, by Loudspeaker 80

New Drives, 15% More Production ..... *Robert Whitney* 82

Maintenance Forms 84

Centralized Lubrication Is Safe and Speedy 86

Maintenance Service Shorts 88

Data Sheets: Electrical Control Troubles and Their Causes 94

What's New in Equipment 106

Catalog Service 170

MAINTENANCE CONTENTS OF THE THREE PRECEDING ISSUES

SEPTEMBER

Editorials 70

We Fight Fire With Gas 71

Room to Spare, With Gearmotors 74

When You Install Capacitors 76

No Dust, Better Health, More Output 79

A Dozen Heads Are Better Than One 82

Our Oilers Are Proud of Their Jobs 84

Maintenance Service Shorts 87

Data Sheets: Effects of Voltage Variation on Motor and Control Operation 92

What's New in Equipment 102

Catalog Service 174

JULY

Editorials 76

Our Power Drives—What and Why 77

Good Electrical Maintenance Cuts Fire Hazards 79

Time Switches Never Forget 82

Interlocked Motors Save Regrets 84

Easier, Faster With Paint Sprayers 87

Loudspeakers Keep Us All in Step 88

Maintenance Service Shorts 92

What's New in Equipment 106

Catalog Service 174

JUNE

Editorials 70

The Facts of Fluorescent Lighting 71

New Life for Old Steel Sash 75

No Vibration From These Hammers 78

Red Tape Gets Maintenance Done 80

We Profit by Dated Motor Upkeep 82

Maintenance Service Shorts 86

Data Sheets: Defects to Look for When Inspecting Wood Ladders 92

What's New in Equipment 100

Catalog Service 194

FACTORY MANAGEMENT and MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

EDITORIALS

L. C. MORROW . . . *Editor*

Light Is Cheap Protection Against Trespassers

MORE HOURS OF DARKNESS, fewer of daylight, give the thief and saboteur increased opportunity for trespassing on industrial plant properties. By the same token the duties of guards and watchmen in protecting their properties against illegal entry are made much more difficult. This situation can easily be reversed and all the disadvantages thrown back on the trespasser by proper lighting.

Watchmen and suitable fences are indispensable in the vitally important work of protecting the country's industrial plants against intruders. But the efficiency of watchmen and guards is much lower at night, in the absence of adequate light. Fences interpose no less of a physical barrier in darkness than in daylight, but they are more difficult to police properly.

When a plant throws a curtain of light around its property, it acquires a barrier through which no intruder can pass without fear of detection. Light is the only medium that can dispel the dark corners and deep shadows which the mischief-maker instinctively seeks.

Adequate lighting of plant yards for protection is neither difficult nor expensive. Basic principles have been well worked out. The equipment needed for any condition is readily available.

You may think that your yards are light enough, and you may be right. To make sure, why not walk around the fence and yards some dark night and see whether there are any shadowy spots where an intruder might conceal himself? If there are, light them up.

Fire Prevention Week Means Just That

EVERY YEAR industry has to chalk up about 27,000 fires against its record. For these fires it has to pay a bill of more than $50,000,000. These estimates, the latest available, give point and emphasis to the reasons for the establishment of Fire Prevention Week, which will be observed during the week of October 6-12.

This year whole-hearted observance of the spirit and purpose of Fire Prevention Week is highly in order. The menace of fire and explosions is ever-present and can be kept within bounds only by unceasing vigilance and scrupulous attention to many details. To this situation present world conditions add troublesome factors.

After a long period of slack business a great many plants are now working at full capacity. It is a matter of record that the number of fires in industrial plants goes up as plant activity increases. That fact in itself is enough to warrant rigorous tightening of every plant's defenses against fire. Such action becomes an inescapable obligation of plants working on materials or equipment called for in our defense program.

Always in times such as these special precautions must be taken to guard against the arsonist and the saboteur.

Formation of an adequate firefighting organization, properly trained and equipped; safeguarding of all hazardous operations; installation of the right kind and amount of firefighting equipment; well-trained watchmen; elimination of hazardous conditions; first-class maintenance of equipment and buildings; good housekeeping—these are the foundation on which every plant must build its fire protective measures.

Give Paint a Chance To Do Its Best

OCEANS OF PAINT are used annually in protecting and beautifying plant buildings and equipment. Cost of the material and the labor for applying it are far from insignificant items in the maintenance budget. Whether the selection and application of paint are always given the attention they should have, may be open to argument.

It is easy to consider that paint is just paint, and that anyone is competent to apply it. Both viewpoints contain enough half-truths to make them dangerous.

Many new vehicles and pigments possessing superior qualities have been developed. Paints especially designed for various specific applications have been worked out, and are capable of giving a quality of service unheard of not many years ago. As a result the paint user is now offered much more protection and longer life for his dollar than ever before. He can take advantage of this offer by making sure that the paint used is carefully chosen for the intended service, and correctly applied over a surface that has been properly prepared.

Granted proper selection, no amount of skill and science in making paints can entirely make up for carelessness in application. If a paint has been designed for application over rusty, damp, or greasy surfaces—well and good. If not, it is the part of wisdom to see that the surface is prepared and the paint applied strictly in accordance with the maker's recommendations.

Motor Troubles I Have Met

Here are some out-in-the-shop experiences with failures whose causes were not apparent at a glance. They will give you clues to work on the next time you are puzzled

LIONEL A. HUNT

Service Engineer, Bepco Canada, Ltd., Montreal

ELECTRIC MOTORS occasionally start to act up in ways that are highly perplexing. Reasons for such behavior may be obscure and not easily found. When such troubles do happen it is frequently difficult to find out what the other fellow's experience with them has been. Here are some of my experiences which I hope will be helpful to others.

1. We were told that a 5-hp. motor drawing about 5 amperes kept blowing a 30-amp. fuse after it had been running about an hour. The fuse box was located about 100 feet from the motor. Since the motor drew a comparatively small current, the electrician at the plant was bewildered by the blowing of the fuse and had done little beyond disconnecting the motor, after which he had gone away in disgust.

Tests showed that one of the lines had become grounded to the conduit between the fuse box and magnetic switch, and since the conduit itself was inadequately grounded there was sufficient resistance to limit the leakage current to 30 amperes or less. The fuse did not blow with this current flowing through it, but the additional 5 amperes taken by the motor caused it to blow periodically every hour or two.

2. A slipring motor with drum controller and resistance grids was rigged up temporarily to operate a skip for handling building materials. The motor suddenly began to act up; it would operate slowly on the first and second notches, but on the third notch would immediately jump to full speed.

It was found that there had been a ground on the grids when they were installed, but this defect had passed unnoticed. The motor vibrated excessively due to slipshod installation, and this had caused one of the rotor coils to become grounded in the slot. At the third controller position the two grounds shorted out a complete rotor phase, causing a sudden motor speed-up.

With another slipring motor on a crane in a stone quarry, two grounds—one in the resistance grids and one inside the rotor—had a different effect. In this instance, the machine operated for years without these grounds being noticed, but the flow of current caused shaft pitting and bearing damage.

3. A motor driving a centrifugal pump was sent in for rewinding because two cast-aluminum fans, one at each end of the rotor, had become so badly distorted that the blades struck the winding. Both fans had been thrown out of line in identically the same manner. The motor had operated for years, and the engineer could find no explanation for the trouble.

From the appearance of the rotor, however, it was obvious that the motor had been operating at three or four times its rated speed. No one would admit it, but there was little doubt that the pump valves had been opened before starting up the motor so that the water backing up through the pump had converted it into a high-speed water turbine, with consequent motor damage.

4. Some years ago a machine operator in a lumber mill complained that a new motor did not have enough power. Tests indicated that the rotor was possibly at fault, but since it was of die-cast aluminum construction this diagnosis was at first dismissed as unlikely. Eventually another rotor was installed, which cleared up the trouble. It was then found that there were minute blowholes in the aluminum on one side only of the original rotor. This condition seemingly resulted in the lack of torque experienced.

An acid-resisting coating, sprayed on this stator, was not able to prevent entrance of acid fumes between coils, resulting in failure. Note etching of laminations

5. On another occasion when lack of power was complained about, this time on a motor driving a feed mixer, tests revealed that the motor actually was heavily overloaded. The operator insisted that there was nothing the matter with his machine and agreed to open the inspection doors only after considerable persuasion. Investigation disclosed that molasses was one of the ingredients in the mixture and was fed in a heated condition into the mixing chamber.

A hard coating of the mixture had formed between the mixing screw and the casing, and had taken on such a metallic shine that the operator insisted it was a machined casting designed to fit closely against the screw. It took two men more than two hours to chisel out the obstruction, after which the motor was accepted as satisfactory.

6. One winter the motor driving a suction fan through speed-increasing gearing was blamed for lack of power. A

quick inspection indicated that the grease in the gear box bearings had congealed. The superintendent insisted that this was not the cause of the trouble, but nevertheless consented to apply a blowtorch to these bearings. This treatment seemed to help and it was decided to dismantle the gear box and put thinner grease in the bearings. This change necessitated removing the hood from the suction fan. After the grease change had been made and the unit reassembled, further tests were made which showed that there was comparatively little improvement.

Someone then suggested replacing the hood over the fan, and immediately motor operation became normal. Evidently the extra work done by the fan had consumed about the same amount of power previously taken by the stiff bearings.

7. A motor driving a lineshaft in a one-story frame building suddenly began to run very hot, without apparent cause. Shortly before there had been a severe snowstorm and careful checking showed that the weight of the snow on the roof had thrown the lineshaft badly out of alignment, thus increasing the load on the motor.

8. An emergency call brought the news in the middle of the night that a motor driving a pump would run only at about 200 instead of 1,800 revolutions per minute. Tests showed that the three-phase voltages were considerably out of balance.

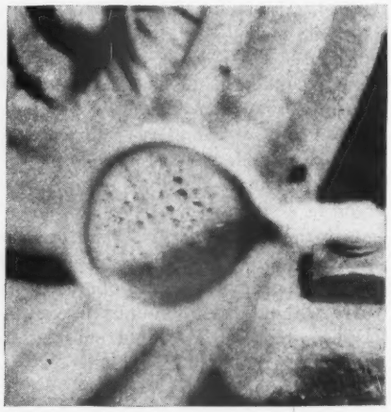
This motor was operated from a compensator having two auto-transformer coils. The combination of these two coils resulted in harmonics which caused the motor to crawl at a small fraction of normal speed. When the motor was removed from the pump it refused to start up with no load.

Another motor was substituted for it and behaved in exactly the same way.

As a last resort another compensator having a three-coil auto-transformer was installed. In this way conditions were improved sufficiently to permit the motor to come up to speed, although with some hesitation. It was not until the line condition was rectified that operation became normal.

9. Sometimes several years elapse before trouble is finally traced down. A 25-hp. motor driving a compressor in a small brass foundry is a good example. At the end of the first and second years the bearings had to be changed; at the end of the third year broken rotor bars appeared; and at the end of the fourth year another bearing required replacing. When the report came at the end of the fifth year that more rotor bars were broken, I decided to investigate.

While carrying out tests an ammeter was clipped over one of the leads and gave a reading of 17 amperes. Without any warning and with no change in the compressor load this reading suddenly jumped to 35 amperes. It was exactly 11 o'clock. Further tests showed that the current was now 35, 27, and 15 amperes, respectively, in the three phases. The motor began to vibrate. With the usual thrill that comes to the troubleshooter when he gets a clue, inquiries were hastily made to find what processes were started at 11 o'clock. It was found that a 100-kw. single-phase arc furnace was started every morning at 11 o'clock. Also, that the single-phase unbalance had been so severe that the power company had had to replace three polyphase watthour meters.



Pinholes in a waterproofing coating, caused by neglect to bake the underlying insulating varnish thoroughly, allowed moisture to get in, and the winding failed

The compressor motor, the largest in the neighborhood, had characteristically tried to rectify the out-of-balance line condition with disastrous results.

10. Installing ordinary motors in wet or cold locations is likely to result in trouble. Some of the most severe conditions to which standard motors are subjected are found in dairies where at times steam envelops the motor and at other times washing down is done with a hose, too often pointed directly at the motor. In such applications only totally inclosed machines should be used, but even these are not a cure-all.

On one occasion two totally inclosed 10-hp. motors were installed beside the steam kettles in a soup factory. Both broke down practically simultaneously and when opened up 5 inches of water was found in each. The rotors were actually running in water. These machines had been in operation about three months. This situation, of course, has been experienced on many occasions and some manufacturers now make a practice of putting drain holes in the bottom of totally inclosed motors. These holes should not be plugged where the motor is operating in cold or humid atmospheres where condensation may occur.

11. Totally inclosed motors used on account of abrasive dust in the atmosphere should definitely not have drain holes. Recently a motor of this type, having a grinding wheel mounted directly on the shaft, broke down. It was mounted at an angle and built into a grinding machine. During heavy snagging operations steel particles rebounded from the side of the casting and found their way through the drain hole into the motor, causing failure of the winding.

12. If a standard motor is to be used in a cold or humid atmosphere, or in locations where acids, alkalies, or metallic dust are present, the winding should be dipped (not sprayed) at least twice in some varnish or compound recommended by the manufacturer for those conditions. On three occasions in my experience motors that had this compound sprayed on broke down, whereas those that were dipped did not. Close examination of two of the motors that had been sprayed revealed that the protective material had not penetrated between the coils, and weak acid had found entrance at these points. Early breakdown followed.

13. An interesting breakdown involved a machine which had been impregnated in a standard insulating varnish and after being baked was given a coat, by dipping, of a moisture-resisting compound. A careful examination was given this machine to ascertain why it had broken down. When the windings were examined under a magnifying glass, the waterproofing coating was found to be perforated with minute blowholes.

They were caused by failure to bake the insulating varnish sufficiently. When the motor was baked the second time to dry out the moistureproofing compound the varnish solvent was driven off through the finishing coat. The resulting small holes destroyed the effectiveness of the moistureproof coating and allowed enough moisture to enter the winding to cause failure.

Stop Vibration, Add to Lamp Life

Filament lamps of ordinary construction cannot stand severe shocks or vibration. When these conditions can't be avoided, use lamps designed for that kind of service

JAMES D. HALL

Engineer, Westinghouse Lamp Division
Westinghouse Electric & Manufacturing Company
Bloomfield, N. J.

James D. Hall is a native of South Carolina and a graduate of Clemson College, in electrical and mechanical engineering. After college, years of experience in plant operation gave him first-hand knowledge of the many problems, including lighting, encountered by operating men. Since going with the Westinghouse Company most of his time has been spent in studies of lamp development, quality, and application. When he wants to forget lamps for the moment he turns to gardening, hiking, and painting, indulging in each as time, circumstances, and mood dictate

SHORT LAMP LIFE is caused, in the great majority of instances, by shock and vibration. The low-amplitude, high-frequency variety of vibration in particular is the most insidious enemy of incandescent lamps because it is not readily detected and hence may not be recognized as being of sufficient severity to affect lamp performance.

When that fact is given the attention it deserves, the application of suitable preventive or curative measures becomes fairly simple.

Vibrating machinery and power shafting are among the most prolific sources of destructive vibration. Attaching lighting equipment to machinery is a sure-fire method of reducing lamp life. Even steel and concrete buildings containing vibrating machinery will transmit harmful vibration to lighting fixtures attached directly to the walls or ceilings, or mounted on rigid conduit, even though the fixtures may be located a considerable distance from the source of vibration. Such conditions are easily overlooked because they are not readily visible or otherwise noticeable.

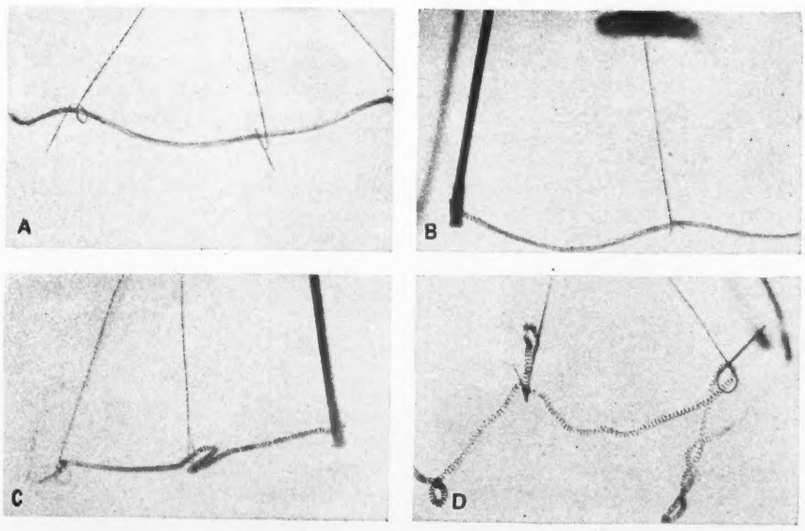


Figure 1. Filaments of 200-watt, 115-volt lamps after burning out in normal and severe service. *A*, not subjected to shocks or vibration; *B*, subjected to moderate vibration; *C*, fairly severe vibration caused stretching of the coils, with short-circuiting of portions; *D*, severe shocks and vibration caused premature failure of this filament

Maximum life of filament lamps, with a consequent reduction of the replacement nuisance to the minimum, may be obtained by exertion of a moderate amount of care in their selection and use. No single pair of pliers will meet all the requirements of a lineman. Many lamp users, nevertheless, often overlook the fact that although the commonly used types of lamps are highly adaptable, no one type is suitable for all conditions of service.

The light-producing element, the drawn tungsten wire filament, is

stronger than the best grade of steel before being heated to incandescence, but like other metals it is rather soft and pliable while heated. Continued heating causes a change in the crystalline structure so that it becomes somewhat brittle and susceptible to breakage when subjected to shock.

When it is realized that the diameter of the filament wire in some of the lower-wattage lamps is much less than that of a human hair and that this wire is wound into helical coils with closely spaced turns (in some lamps, more than 2,000 turns per inch), it will be evident that vibration and shock are likely to distort and short-circuit sections of the coil and thus exert an extremely adverse effect on the life of the lamp.

Figure 1 shows enlarged filaments from 200-watt lamps which gave short life in service. As will be seen, the coils are stretched and distorted, with sections of the filament short-circuited, thus causing the remainder of the filament to operate at overvoltage, with a consequent reduction in the life of the lamps.

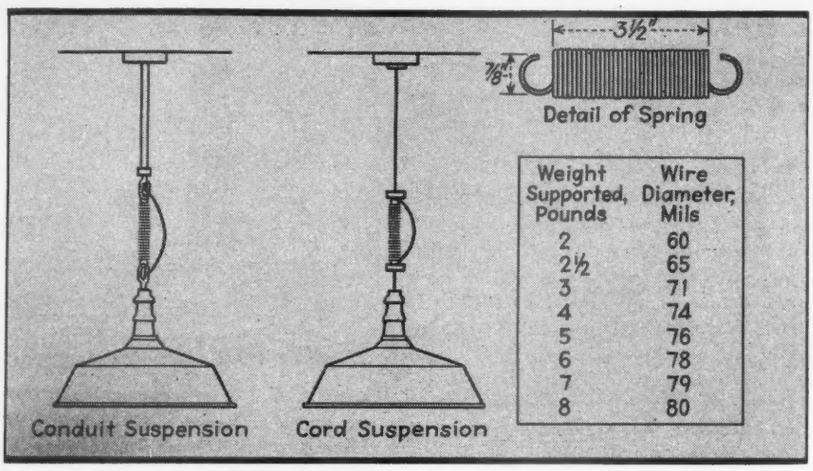
Assuring Maximum Lamp Life

Longer life of lamps subjected to vibration can be obtained by (1) protecting the lamps from vibration, or (2) using lamps of a different type or of a special construction designed to withstand vibration better.

Of the two methods the former is to be preferred because it allows the use of standard, general-service lamps which are more efficient, more easily available, and less expensive. For example, the 50-watt, 115-volt, A-19 bulb, inside-frosted lamp lists at 13 cents and produces an initial light output of 660 lumens, whereas the 50-watt, 115-volt, P-19 bulb, vibration-service lamp lists at 20 cents and has an initial light output of 545 lumens.

The higher the wattage of a lamp of given voltage the greater the diameter of its filament wire and hence the better its ability to withstand shock and vibration. Advantage may be taken of this fact by replacing localized illumination from many low-wattage lamps with general illumination obtained from fewer higher-wattage lamps located further from the source of vibration. This change will result in decreased lighting cost and better service because of the use of a smaller number of lamps which are more resistant to vibration and produce more light per watt.

If local illumination is necessary, care should be taken not to attach the reflector or the lamp cord directly to the machinery, if it can possibly be avoided. It is preferable to support the fixture from the ceiling or the floor, where vibration is usually less severe.



Weight Supported, Pounds	Wire Diameter, Mils
2	60
2½	65
3	71
4	74
5	76
6	78
7	79
8	80

Figure 2. Lamps can be protected from vibration by suspending the lighting fixtures on coil springs made from steel music wire of the proper diameter for the weight

Shock-Proof Sockets

For the protection of lamps used in fixtures supported from the ceiling, there are available a variety of shock and vibration-proof sockets and hangers. Where vibration is severe, this type of equipment usually pays for itself in a short time.

A closely coiled helical spring of steel music wire as shown in Figure 2 has been used to support lighting fixtures with excellent results. The diameter of the wire in the spring should be such that the supported weight will extend it about 50 percent.

Where it is impracticable or undesirable to make a change in the method of mounting or supporting a fixture in order to protect the lamp from vibration, a device known as the *VR* adapter may be used to advantage. This device is similar to a socket extension in that it consists of a medium screw base attached to a medium screw socket. Base and socket portions of the adapter are connected by means of a coiled spring for absorbing the vibration which ordinarily would be transmitted to the lamp filament. The adapter is screwed into

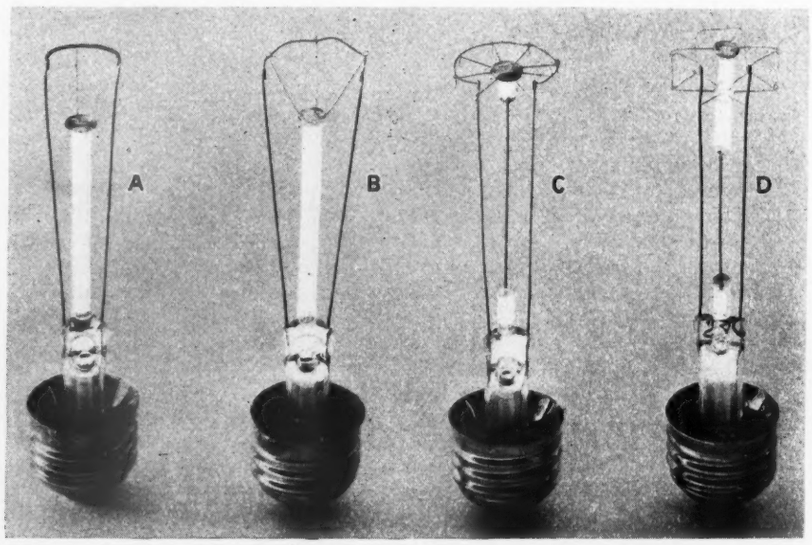


Figure 3. Construction features of 100-watt Mazda lamps for different service conditions. *A*, 30-volt train lighting; *B*, 115-volt general lighting; *C*, 115-volt vibration service; *D*, 115-volt rough service. Note methods of supporting the filament

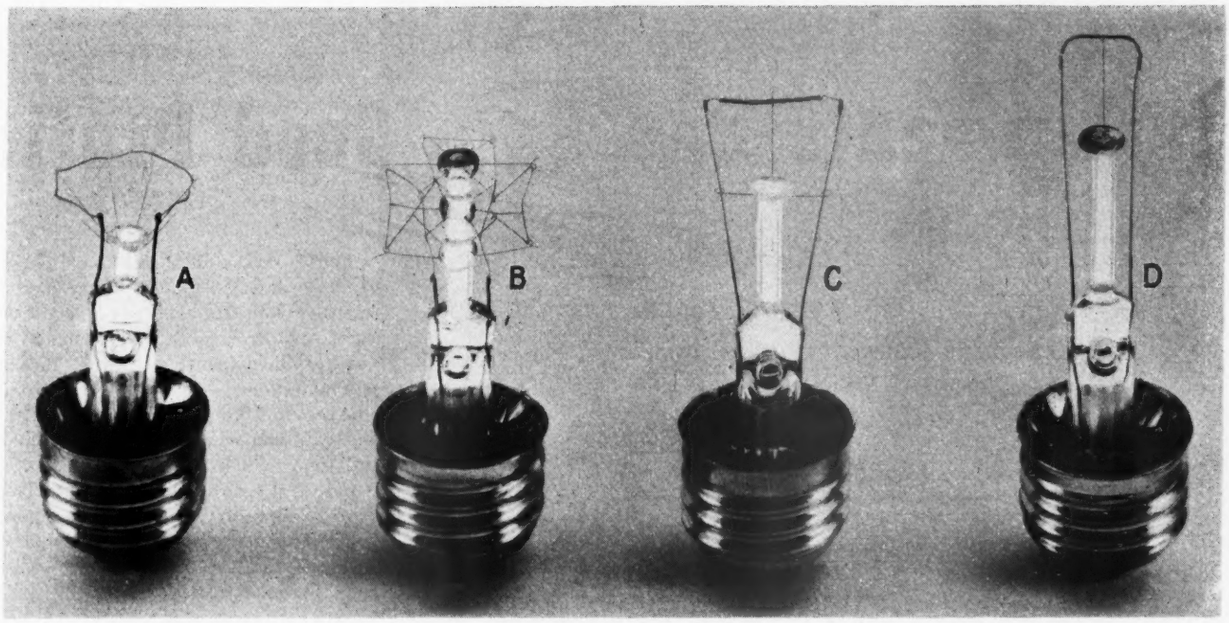


Figure 4. Filaments of 50-watt Mazda lamps are supported in various ways, depending on the service for which they are designed. Shown: *A*, 115-volt vibration service; *B*, 115-volt rough service; *C*, 115-volt general lighting; *D*, 30-volt train lighting

the lamp socket and the lamp, in turn, is screwed into the adapter socket.

Use of an adapter, in effect, increases the over-all length and consequently the light-center length of the lamp by approximately 1¾ inches; hence limited space or the necessity for accurate location of the light source with reference to the reflector may preclude the possibility of using an adapter. These devices may be obtained from the manufacturers of Mazda lamps.

If There Is Vibration

For use where it is not feasible to provide some form of protection, there is available a standard 50-watt, 115-volt, P-19 bulb "vibration-service" lamp. Vibration-service 75 and 100-watt, 115-volt, A-bulb lamps also are available. (See Figures 3 and 4). The design of these lamps embraces, among other features, the use of added filament supports and a special type of filament wire. The additional supports conduct heat from the filament coil, thus reducing the amount of light produced by the lamp, while the performance of the filament wire is such that the falling off in light output throughout life is somewhat greater than that of the corresponding general-service lamp. These facts, plus the higher price of the vibration-type lamps, make them uneconomical for use where vibration is not present.

Where local lighting with the lower-wattage 115-volt lamps and fixtures attached directly to the equipment is necessary, as on sewing machines or shoe machinery, the specially designed "home appliance" lamp is usually the most satisfactory type. It is available in ratings of 15, 20, and 25 watts, and with the double-contact, bayonet candelabra, automotive-type base. The 25-watt lamp is to be preferred, because of its greater strength. Tubular bulbs ⅞ inch in diameter are used for the 15-watt lamp, while the 20- and 25-watt lamps are 1 inch in diameter. Since these lamps are only 2⅝ inches in over-all length, small fixtures are possible.

For lighting of this type, however, it is preferable to use standard 15-, 25-, 50-, or 100-watt, 30-volt, A-bulb train lighting lamps operated from a 115/30-volt transformer. These lamps, which are of the same general appearance as the corresponding standard 115-volt lamps, have shorter and much more rugged filament coils as shown in Figures 3 and 4, and are better able to withstand vibration and shock. In addition, they produce more light per watt than the corresponding 115-volt lamps.

For Extra Severe Vibration

Where vibration is especially severe the standard 15-watt, 34-volt, S-14 bulb, locomotive cab lamp is particularly suitable, although its light output is somewhat less than that of the 15-watt, 30-volt train lighting lamp.

For local lighting there also is available a 15-candlepower, 8-volt, S-8 bulb, double-contact, bayonet-base lamp. This lamp, of course, requires the use of a transformer. Its principal application is the lighting of sewing machines.

Rough-Service Lamps

Use of portable extension cords brings about one of the most severe conditions to which a lamp can be subjected. In such service very little can be done to protect the lamp from shocks; for it there are available "rough-service" lamps (Figures 3 and 4) incorporating the use of a relatively large number of specially arranged filament supports. Standard 50 and 100-watt, 115-volt, A-bulb, rough-service lamps are regularly available, while the 150 and 200-watt ratings may be had on order. Rough-service lamps rated 50 and 100 watts also may be had on order for 220 to 260-volt circuits.

Rough-service lamps are lower in efficiency and higher in price than the corresponding general lighting service lamps and hence should be used only where necessary because of the severity of the operating conditions.

For inspecting the interior of casks, barrels, and so on, where the lamp must be inserted through an opening of limited size, it is best to use standard 15 or 21-candlepower, 6 or 8-volt automotive-type lamps. Such lamps may be operated from a toy transformer or storage battery.

Instruments Pay Us a Good Profit

That's why they use the appropriate number and type of instruments—300 in heat-treating alone—on every job to which these aids to management can well be applied

CHARLES E. ARMSTRONG

Plant Engineer, Caterpillar Tractor Company, Peoria, Ill.

OUR EFFORT is to apply instruments in our plant adequate for each operation, but to avoid instrumentation merely for the sake of instrumentation. We have, for instance, a total of 300 instruments in our various heat-treating operations, exclusive of those in the laboratories. The point of having all this equipment is obviously that it permits precise regulation of temperatures, with the resultant assurance of the desired results. A secondary benefit is in the fuel savings. A third benefit is that rejections on Brinell and similar inspections are reduced to a minimum.

We have never taken the trouble to compute the dollars-and-cents extent of these savings. But it seems a conservative estimate that any one of the three savings is more than sufficient to pay for the expense of having the instrumentation — including carrying charges and the special men in the electrical department who devote their full time to this equipment.

Before the development of automatic control apparatus we depended on hand control of fuel valves with the aid of an indicating potentiometer or resistance pyrometer. But every once in a while the temperature would fall off, the fuel valves would have to be opened to allow a considerably greater flow, and the quality of the work would fall below a certain standard.

Now, when a furnace goes off its temperature control point, a telephone call brings the instrument specialist who quickly corrects what is wrong.

The instrument which is being adjusted was rebuilt to record two temperatures at once and control separately the flue valves on the two burners of a carburizing furnace

Call for the Specialist

The engineers design the production equipment and its instrumentation, but when it gets into everyday use it sometimes proves to need something a little different. For instance, we have a group of batch-charge carburizing furnaces which used to be hand-controlled according to the temperatures read from indicating instruments. Then these furnaces were equipped with a recording-controlling instrument, with its controls set so that they turn the front and back valves up or down simultaneously. With hand control the tendency had been for the back to run too hot and the front too cool, or *vice versa*—which was why the recording control was installed. But the tendency continued.

Finally our instrument specialist worked out some changes on a standard instrument which he figured would make it do a satisfactory job of giving a two-line reading on two thermocouples inside the furnace, using an individual control on each of the fuel valves. Thus each valve would be permitted to apportion the amount of fuel to its end of the furnace required by the temperature. The instrument manufacturer agreed that it would probably work.

So these parts were made by hand and incorporated in the instrument.

Ever since, the instrument has given us a solid line for the front of the furnace, a dash line for the back. The ideal is to have them coincide, so that only one line can be seen. Perhaps 33 percent of the time they do so; the remainder of the time they are not 5 degrees apart, criss-crossing hundreds of times a day. Quality of output has been uniform, and right, ever since. And fuel consumption per ton of charge has decreased appreciably. As a result we are using several similarly adapted instruments in other places where the need was demonstrated, and all have been successful.

Getting the Right Pressure

On a cyaniding operation an entirely different principle is used. Here an indicating-controlling instrument is mounted with two lamp bulbs which are in parallel with each other and in series with an electric valve. For a comparatively low rate of fuel feed the instrument turns on the smaller lamp, which permits the flow of sufficient current to open the feed valve part way. If more is needed the second lamp goes on, increasing the flow of current and thus opening the valve wider. As soon as the temperature passes the level for which the instrument is set it turns off both lamps in reverse order, and the cycle presently is repeated. By varying the wattage of the lamps used, which varies the degree of valve opening, any desired gas pressure can be maintained.

On a hardening operation we use a three-zone, gas-fired furnace having a conveyor which takes the material through the chamber. Each zone, of course, has its own thermocouple connected with an instrument. The first two zones are controlled by two-position, on-and-off valves which in turn are controlled by an indicating-controller potentiometer. The critical third zone is controlled by a proportioning valve which changes the aperture for the fuel flow valve in very small steps, the change being in proportion to the change in temperature.

A continuous flame is maintained for the sake of a steady temperature. This valve is controlled by a recording-controller potentiometer through an electronic relay which shows an almost straight vertical line on the chart, with a slight jog whenever the furnace is opened. If the chart gets 5 degrees Fahrenheit off the ideal, a call goes out for the instrument man.

On low-temperature furnaces operating at levels no higher than 900-1,000 degrees Fahrenheit we use as a safety precaution, along with the recording-controlling potentiometer that holds the temperature at the desired level, an additional electronic-type control instrument that shuts off the fuel supply if the pilot light goes out.

A modified recording potentiometer mounted on a small truck is used by the electrical shop for testing new furnaces, determining heating rates, fixing thermocouple location

For example, in a low-temperature normalizing furnace which operates below 400 degrees Fahrenheit we use this electronic-type control instrument in which a small current is passed through the pilot flame itself to hold open the fuel valve. If the flame goes out, the circuit is broken and the fuel valve closes automatically, preventing the possibility of a subsequent explosion.

Flame Control for Safety

In a low-temperature drying oven we also use a flame control to reduce explosion hazard. For controlling the two-position on-and-off valve we use an indicator-controller which is set to the desired temperature.

In an electric rotary furnace with two heat zones we use a straight indicating potentiometer controller for one zone, the pre-heating. For the second, critical zone, we use a recording-controller potentiometer.

Where we have a battery of electric normalizing furnaces, we use still another type of instrument for control. In addition to a recording potentiometer-controller the electric input is proportioned to the needs of the furnace. As in all instances where a recording instrument is used, the operator looks at the chart every few minutes.

With high-temperature furnaces, operating up to 2,600 degrees Fahrenheit, we use a special high-temperature radiation unit mounted on the outside. This unit is equipped with a lens for concentrating the rays from the furnace interior onto a thermocouple which in turn transforms the radiant energy into electrical energy, recorded as temperature on a recorder-controller located some distance away.

On other equipment we use an indicating-type potentiometer-controller controlled by photoelectric cells through a beam of light reflected from a mirror attached to a galvanometer. When the furnace temperature reaches its upper limit, the light no longer reaches the photocell and the fuel feed is shut off.

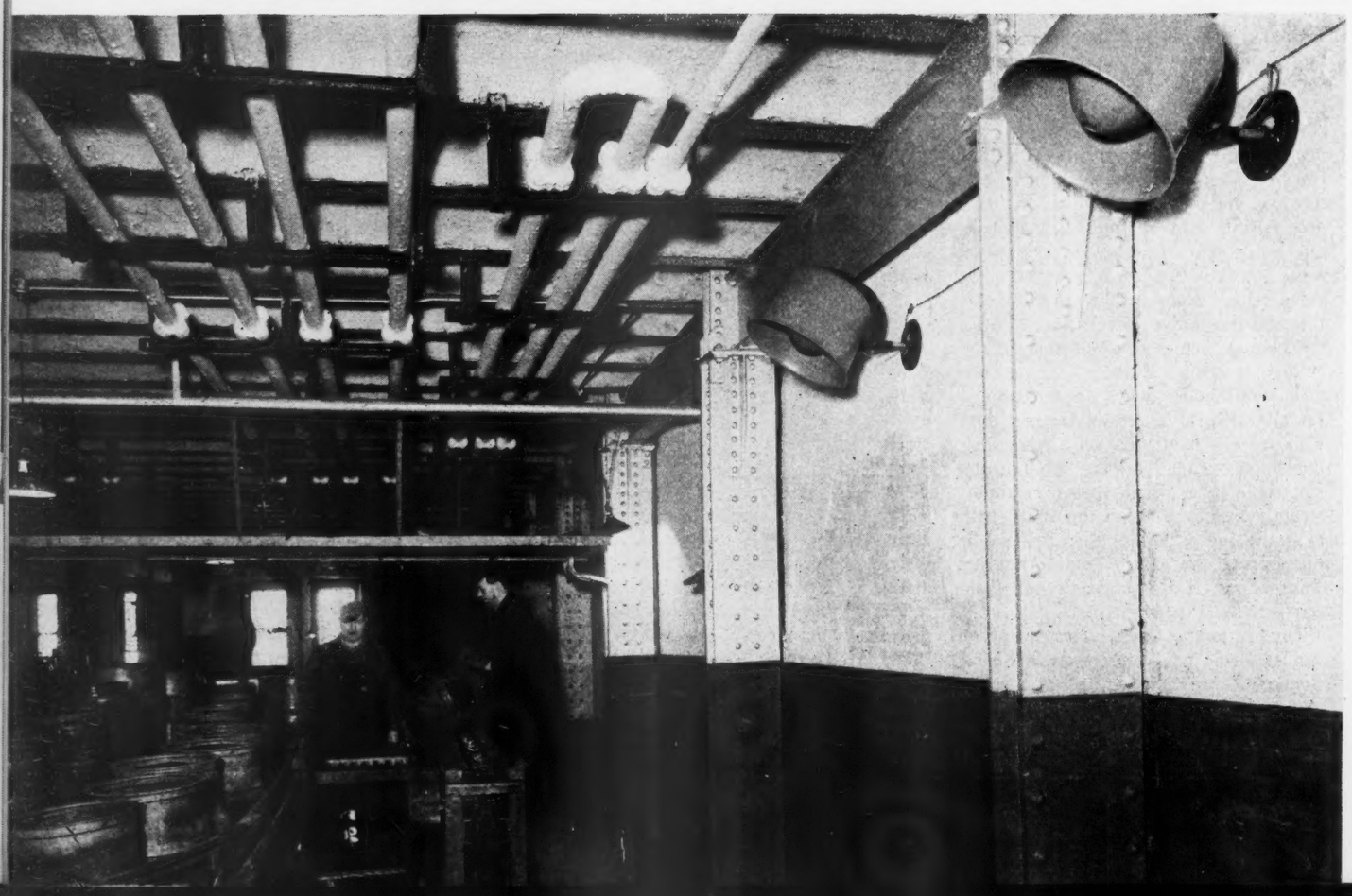
For testing, the electrical maintenance shop uses what is essentially a recording potentiometer with some adaptations, mounted on a small truck. It can indicate and record the temperature of one, two, or three thermocouples, depending upon the test to be run.

Into Every Ear, by Loudspeaker

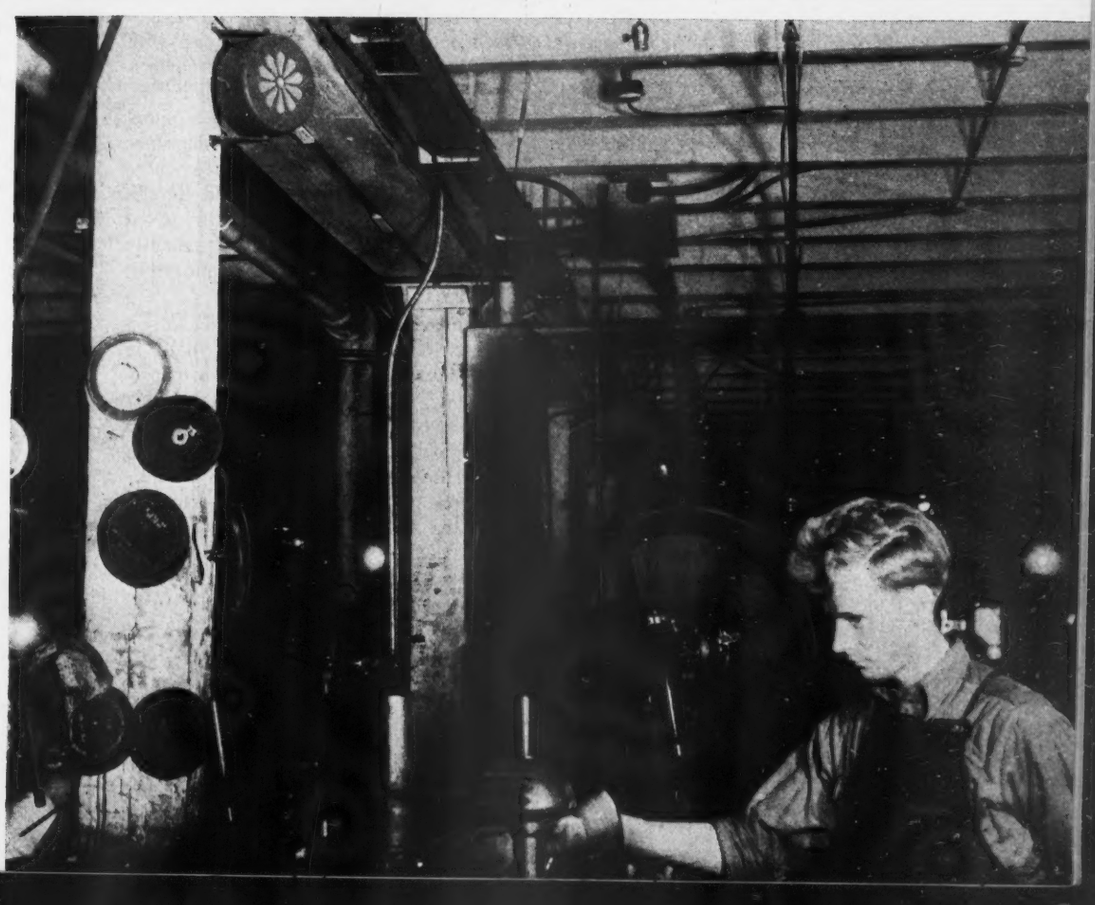
Truckers in an oil company warehouse waste no time going to the office for orders; they came over a Webster-Chicago system

In this plant the lunch period of employees is enlivened by music or special announcements sent out over a Western Electric system

A brewery enlightens 5,000 visitors a week over Atlas Sound horns, from a record. To start, a guide pushes a button at each station



Refreshments in the middle of the afternoon and lively music played over Sundt system speakers go a long, long way towards keeping output at full volume to the end of the day, by routing hunger and fatigue



Twenty Operadio speakers mounted around the plant of a furniture manufacturer serve to locate, by vocal paging, officials and others who are wanted on the telephone. They cut waiting time 75 percent

New Drives, 15% More Production

Changing from an old lineshaft drive to combination of unit and small group drives brought savings of $2,500 a year, and a new layout that ups production 15 percent

ROBERT WHITNEY

Superintendent, Dover Stamping and Manufacturing Company, Cambridge, Mass.

Robert Whitney attended Boston University College of Business Administration before going with the Dover Company in 1935. After serving as foreman of the stamping and galvanizing departments he became assistant superintendent, and two years later assumed his present position. His special interest in time study and plant layout led to the changes which he describes in this article. Most of his spare time is spent in remodeling a small farm tucked away in the hills of New Hampshire

A 15 PERCENT INCREASE in production and a clear saving of approximately $2,500 a year in operating costs are two of the most important benefits derived from revamping our power drives and rearranging many of our production machines according to new layouts which the new drives made possible. With these savings have come other incidental but none the less worth-while advantages.

Our production covers more than 500 different items formed from parts stamped out on punch presses. These presses and various other power-driven machines used in assembling and finishing our products are located on the first and second floors of the main factory building. For upwards of 70 years power for driving all the machines was furnished by a large steam engine located in a power plant adjoining the main building. A 185-ft. lineshaft turning at 145 revolutions per minute ran almost the entire length of the first floor and drove all the machines on it, mostly through countershafts.

Once the Best

At one end of the second floor there was an 80-ft. lineshaft driving a group of about a dozen machines, and a 150-ft. shaft driving a much larger number of machines at the other end. These shafts were in turn belted down to the main lineshaft on the first floor.

This arrangement was commonly used in the old-time plants and in the days when it was installed it was about the best that could be had. Today it is badly outmoded, because it has inherent limitations which may make it fall far short of meeting modern production requirements. For one thing, we have found that under our conditions power can be purchased much more cheaply than it can be generated. In our plant the saving amounts to at least $2,500 a year.

More important, the old system of transmitting power utterly lacked the flexibility we needed. Not all our presses and other machines have to be operated continuously, but regardless of how few machines might be needed for production at any particular moment, the power plant and whole power transmission system had to be operated in order to run them.

Another serious disadvantage came through our inability to locate machines just where they should be placed in order to get the most efficient layout. To meet new needs and keep up with increasing production requirements, new machines had been installed from time to time over a period of many years. Granted that there was sometimes failure to place these machines where present practice in layout would dictate, it is nevertheless true that the fixed location of the lineshafts frequently gave us little choice in the matter of placing the machines.

The result of placing machines to suit the drive facilities, rather than in accordance with the natural flow of production, was to increase considerably the amount of handling of raw materials and parts. In a number of instances, parts had to be trucked a considerable distance to the machine that performed the next operation, simply because we could not locate the two machines side by side.

We were, of course, fully aware of some of these shortcomings in our layout, and during the past year we have been doing a thorough-going job of removing them.

One of the first steps was to make a new layout for the production departments on the first and second floors. Punchpresses and other machines were placed to give as nearly straight-line flow of materials and parts as possible. In passing, it may be said that circumstances made it necessary to adopt certain compromises.

Much of our production is of seasonal nature. For example, at one time of the year orders for garden sprinkling cans, say, are heavy. At another the schedules call for large numbers of ash cans and certain other items. On the other hand, production of some other

products remains at a fairly constant level throughout the year.

Practically all of our products consist of several parts which are assembled by soldering, spinning, welding, or riveting. Any one punchpress may produce from ten to twenty kinds of parts in the course of a year. Inasmuch as the sequence and character of the subsequent assembly and finishing operations are different for each product, the best that can be done is to lay out the machines in such fashion as best meets all of the conditions. In other words, no one layout will meet all conditions equally well.

Even under these limitations the new layouts have enabled us to make substantial reductions in the total amount of handling required, as well as in the distances traveled by parts in passing through the fabricating operations.

It had been decided previously to discontinue use of the steam engine, and purchase our power. But the question of the kind of drive to be used for each press and machine still had to be settled.

It was obvious that some combination of group and individual or unit drives would best meet our needs most economically. The nature of our production as well as the manufacturing schedules is such that the output of many of the presses goes directly into stock, from which it is withdrawn as needed. When a press finishes the number of parts called for on a shop order, it may or may not remain idle for a time. In any event, not all our presses are required to run continuously.

It was felt, therefore, that the presses and certain other machines having similar operating schedules could with advantage be converted to unit drive. With this type of drive we were able to locate the presses just where they should be in order to secure the most efficient layout.

Also, we were able to place ten punchpresses and a blanking press at an angle so that long lengths of bar or strip stock can be handled. Heretofore, all presses had been lined up straight, and it was necessary to cut the stock into short lengths, because the distance between presses was small. This simple change has resulted in a considerable saving in time and labor.

Another saving that is incidental, but important, has come in consequence of placing the presses at an angle and somewhat farther apart. It is now possible to change dies more easily and quickly, since there is plenty of room to work in, and the elevating platform truck on which the dies are handled can be brought right up to each press.

Little difficulty was encountered in changing the presses and other machines to unit drive. Most of the presses require motors of 2- or 3-hp. rating. With a few exceptions the motors are supported on welded angle-iron platforms bolted to the back of the presses. All motors are mounted on belt-tensioning bases. In a few instances it was necessary, or more convenient, to mount the motor on the floor.

It was desired to drive the presses at the speeds formerly used; therefore most of the motors run at 900 or 1,200 revolutions per minute. They are 550-volt, 60-cycle machines, and are controlled by pushbuttons on the presses.

Photograph by courtesy of The American Pulley Company

At the left are a few of the presses that have been converted to unit drive. Right, two barrel lines, each comprising six machines, driven in a group from one lineshaft

Belts are of the V-type, running in grooved sheaves on the motor shafts and over the flywheels of the presses. It was necessary to remove the crown on some flywheels, in order to keep the V-belts from running off.

Some individual machines run continuously during working hours, while others are operated in a group, as a unit. What we term the barrel lines are a good example of such a group. We have two such lines, each consisting of six different kinds of machines required to turn out large galvanized cans or barrels. The work goes in sequence from one machine to another, and there would be no need to operate one or two machines, say, without the others. Such groups are well suited to group drive. Hence we are driving both barrel lines from one lineshaft driven by a 7½-hp. motor through V-belts.

Group drive was also retained in the machine shop, which is well equipped and contains a considerable number of power-driven tools. In addition, there are several other comparatively small groups of production machines which are operated more or less as a unit, and it was felt that they could be driven most economically from a lineshaft.

Now Five Lineshafts

Altogether we have changed about 35 machines to unit drive, while 45 or so are driven from lineshafts, of which there are now five. These figures do not include the drives in one department in which changes are still to be made.

Tearing down the old lineshafts and relocating the machines involved a good deal of work, but it was done with practically no loss of production time. Careful planning of production schedules made it possible to build up a sufficient stock of parts to carry us over temporary interruptions. All the preliminary work, such as wiring, was of course done beforehand, and in so far as possible the machines were moved and set up in the new locations over week-ends.

Along with these changes in machine location and drives the lighting system was completely revamped and the intensity of illumination stepped up about 400 per cent. Heretofore drop cords provided local lighting for many of the machines. Although they served their purpose well enough, there are so many disadvantages connected with their use that we decided to do away with them entirely.

The new fixtures, comprising RLM Domes with 300-watt lamps, have obviated general use of local lighting.

Maintenance Forms

1. Ordering the Work

Paper work is a necessary preparation, accompaniment, and follow-up for mechanical and electrical work—for new construction, repairs, and maintenance. In this and later issues FACTORY presents sample forms

1. Wagner Electric Corporation. Form *1A* is used by operating departments to initiate maintenance jobs. To order the work, the maintenance department issues a yellow duplicate of *1A*, which goes to cost department after receiving executive approval. After approval, a blue copy is sent to departments doing the work. If the job requires less than 5 hours' work, the request is made to maintenance on *1B*, and work is ordered on a form very much like *1A*. Minor repairs, reported verbally or by phone, are listed on mimeographed "trouble sheet" from which maintenance men take their cues without formal orders

1A

EQUIPMENT ORDER

CHIEF ENGINEER
SUPERINTENDENT
ASST. GEN. MGR.
COST DEPT.

Job No. _____ Equip. No. _____

ISSUED TO _____

Description of Apparatus wanted _____

USE _____

When needed _____ Section No. _____

APPARATUS IS TO BE MADE FOR	ESTIMATED COST	CHECK REASONS FOR ORDER			
Type and Size	L.	Repair		Drw. Change	
PART	M.	Addition to		Tool design	
D'w'g & Part No.	Ex.	Replacing		Workmanship	
Ordered by	To.	Altering		Ex. Exp. Work	
Date Ordered Date Fin.				Low Est.	
		New Equip.		Inc. Prod.	

O. K. Supt. _____ O. K. Chief Eng. _____

O. K. Ass't G. M. _____ O. K. Cost Dept. _____

1B

EQUIPMENT REPAIR ORDER.

..... Dept. ..... 19.....

JOB No..... EQUIPMENT No..... NEEDED BY .....

DESCRIPTION OF APPARATUS.....

WORK TO BE DONE.....

This order must be made out for all repairs of factory equipment.
Superintendent's O. K. must be obtained for all work requiring over five hours to complete.
NOTE—For all new apparatus and alterations, an equipment requisition must be made out.

ORDERED BY ..... O. K., SUPERINTENDENT.

2A

IS IT NECESSARY?

ORDINARY REPAIR JOBS

JOB ORDER NO. _____

TO _____ SHOP _____ DATE _____

DESCRIPTION OF WORK TO BE DONE

REQUESTED BY

DEPT.

FOREMAN

OVERSEER

2. Bigelow-Sanford Carpet Company, Inc. Made out in triplicate and sent to the maintenance office, form *2A* is passed along to foremen of maintenance departments that must do the work. For large repair jobs or new installations, copies of *2B* are formarded to each maintenance foreman concerned

2B

BIGELOW-SANFORD CARPET CO., INC.
Thompsonville Mills

Shop Order _____.

DATE 19

TO THE SHOP:

DESCRIPTION OF WORK TO BE DONE:

OVERSEER

Charge to Dept. Standing Order No. Date Completed

ORDER NO.

INSTRUCTIONS TO:

REQUEST FOR ORDER

DEPT. DEPT. DEPT.

ASSET NUMBER

DRAWING NO.

PART NO.

PATTERN NO.

AUTHORIZATION NO.

ESTIMATED COST

DATE ISSUED

ISSUED BY

APPROVED BY

DISPOSITION

NAME OF ASSET

MAKER

ADDRESS

BOUGHT OF

ADDRESS

INVOICE NO.

MAKER'S NO.

PURCHASE ORDER NO.

3A

MECHANICAL TROUBLE ORDER

Nº 814626

Make following repairs to—Mach. No. Bay No. Dept. No.

Reported A.M. P.M.—Date 19

Employee No. Foreman.

The above repairs completed and Machine, Tool in operation

A.M. P.M.—Date 19

Order No. Foreman.

3B

3. Chrysler Corporation, Plymouth Division. Any supervisor can request construction or equipment on form *3A*, but his superintendent must approve the request. If job will cost more than $25, higher executives must also approve. If job is under $25, maintenance superintendent issues Odd Job Order (not shown). If repairs are needed, form *3B* is issued in triplicate by a maintenance foreman after verbal or written notification; it is time-stamped at start and end of job; materials are listed on back

4

STEEL AND TUBES, Inc.

PLANT ORDER

NO.

WORKS

DEPT. NAME DEPT. NO. ACCT. NO. ISSUED WANTED

ORDERED BY APPROVED BY PROMISED

APPRO. NO. COMPLETED Date O. K. Foreman

4. Steel and Tubes Division, Republic Steel Corporation. Requests for maintenance go to cost accounting department. Cost accounting issues plant order to maintenance department, with copies to engineering and foreman doing the work. Upon completion of the work, maintenance sends original to ordering foreman who OK's the order and forwards it to cost accounting for closing

5. Corning Glass Works. Each trade involved receives a copy of this form, made out by order clerk on any foreman's request and approved by plant engineering department. Each foreman returns his copy to clerk when he finishes his work

5

WORK ORDER - PLANT ENGINEERING DEPARTMENT

Corning Glass Works, Corning, N. Y.

Date Issued:
Complete by:
Requested by:
Issued by:
Approved, Plant Engr. Dept.
Date Needed:
Confirming:

Equipment No.:
Serial No.:
Bulletin No.:
Development No.:
Department No.:
Charge to S. O.

Blacksmith	Carpenter	Elect.	Eng. Dept.	Laborers	Machinist	Masons	Millwrights
Painters	Pattern	Pipe Shop	Tin Shop	Welders	Element Dept.	Sign Painters	

Dept. #60		Labor	Material	Overhead
Total Actual Cost				

RETURN TO ORDER CLERK WHEN COMPLETED

Date Completed Foreman

6. A. E. Staley Manufacturing Company. Original of this work order stays in mechanical department numerical file while copies go to mechanical department building file, storeroom, cost department, building foreman, maintenance foreman

6

Chge.

Job No

A. E. STALEY MANUFACTURING CO

DEPT. IN CHARGE: Date
Cooperating Depts.

WORK TO BE DONE

WHERE:

WHAT:

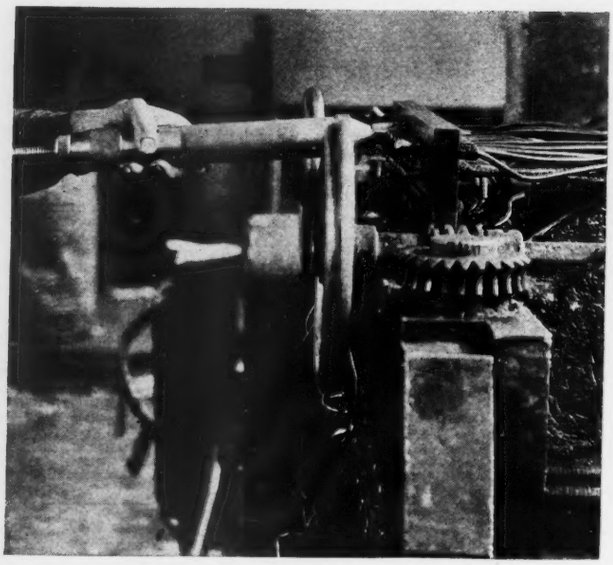
When Start	To be Completed
Requested By	How Received / Order Taken by: Time

ESTIMATED COST:
Labor $
Material
Burden
Total

ACTUAL COST:
Labor $
Material
Burden
Total

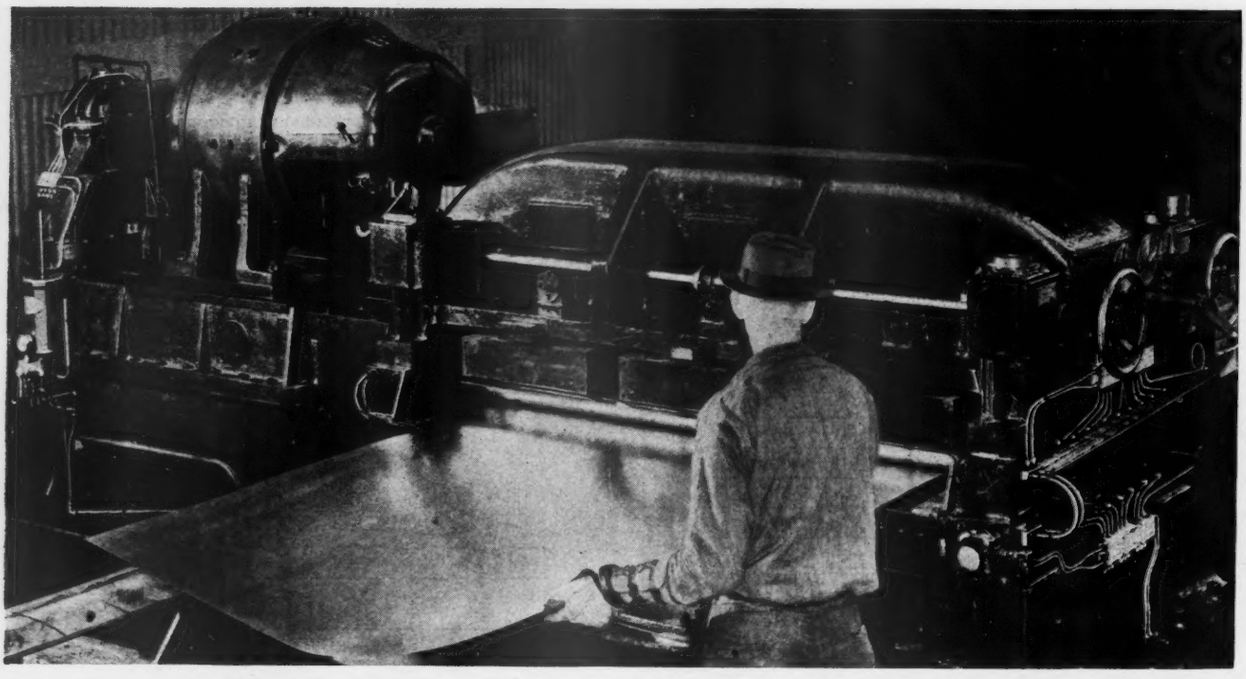
Over or Under Estimate $

Centralized Lubrication Is Safe and Speedy



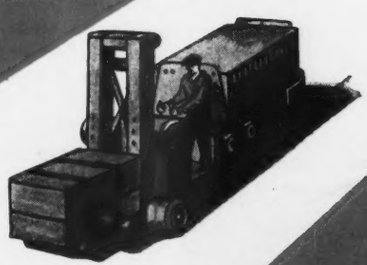
Greasing heavy rolls in a sheet-metal plant isn't the job it used to be—an Alemite system has made it lots safer and easier now

Each of the 32 bearings on this filling and capping machine gets the right amount of oil automatically from a Bijur lubricator



On a roller leveler 68 bearings are lubricated in less than a minute by a Farval unit, and each gets exactly the amount needed

Give your industrial trucks 34% MORE POWER



Exide
IRONCLAD
BATTERIES
With Exide **MIPOR** Separators
"MIPOR," Reg. U. S. Pat. Off.

EXIDE-IRONCLAD BATTERIES assembled in steel trays pack greater battery power into the same space. In a typical instance, a battery with 34% more power and 20% higher voltage was installed in the battery compartment of an electric industrial truck.

The inevitable result is more power for heavier loads and steeper grades, greater speed, pep and liveliness... and more materials, steel coils, freight or cargo handled every hour of the day.

The Exide System is a further contribution to today's handling demands. It scientifically determines the right size and type of Exide-Ironclad Battery for your needs. It guards against costly delays and "tow-ins" with the help of the Exide Discharge Indicator. And it makes battery charging as simple as rolling off a log by means of the Exide Charge Control Unit.

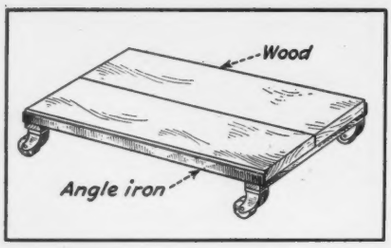
Write for new, free booklet, "The Exide System for Better Material Handling."

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Maintenance Service Shorts

Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

BUILDINGS, SERVICES, MAINTENANCE



Cheap Truck Makes Light Work of Moving Motors

H. SAUVÉ, *Temiscaming, Que., Canada*

The illustration shows a simple truck which is very handy for moving motors around while they are in the repair shop. It can easily be made from a couple of pieces of angle iron, four casters, and a few thick boards.

Such trucks will also be found convenient for storing spare motors on the floor. This is particularly true when, as is usually the case, space is limited and a number of motors may have to be shifted around in order to get at the one that is wanted.

•

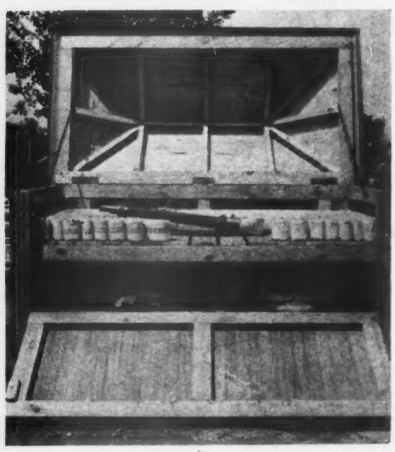
Fire Hose Maintenance Cut by Special Hose Houses

W. H. BANTHIN, *Crivits, Wis.*

Fire protection for large quantities of logs and lumber in a saw mill necessitated a number of outside fire stations. During years of expansion and rearrangement these stations had been located haphazardly, and numerous replacements had been necessary due to tears, cuts, oil rot, gophers, birds' nests, and burns. This maintenance of from 150 to 500 ft. of hose at 21 different stations had required an average annual cost of $12.20 per station; besides, the hose's condition at time of an emergency was always uncertain.

To remedy these conditions, a new type hose house was developed and standardized for all locations. These houses were constructed 3½ feet wide, 7 feet long, and 3 feet high. Materials used were 2x4's for the framing, ⅝-in. beaded siding, and fire resisting tar paper shingles for the roof. One-inch diameter holes were drilled in the bottom and a metal ventilator placed on the top to provide a circulation of fresh air. All holes were covered with fine-mesh copper wire screen to prevent entrance of birds and other animals. For ease in removing the hoses, the entire top section was hinged, and when lifted exposed a nozzle, two wrenches, and from 2 to 4 coupled lengths of hose. One side was hinged and normally held closed by two swivel blocks. When this side was dropped it exposed from 2 to 6 additional lengths of hose and an additional set of wrenches.

These hose houses have been in use for the past two years and resulted in a



decrease of maintenance cost from $12.20 to $.18 per station. (The $.18 per station represented the cost of two stolen wrenches.)

These hose houses were constructed by the mill's own millwrights, and out of regular production materials, for a cost of $22 per station including cost of foundation posts. On the basis of the previous year's averages for replacements, the hose houses have paid for themselves during the past two years and will reflect a direct net saving during this present year. There is also the assurance that the equipment will be ready and in perfect condition for any emergency that may occur. This value is not measurable until the future shows what damage might have been done, yet it gives management one less hazard to think about.

•

Easy to Keep Clean When Painted with Aluminum

PAUL J. RASMUSSEN, *Corvallis, Ore.*

Here on the Pacific Coast, a great percentage of our factories are framed timber construction. Timbers around machinery soon get a coating of oil, and are hard to keep clean.

I find that by giving the timbers a generous coating of flaked aluminum paint before machinery and bearing supports are installed, makes the task of keeping them clean relatively simple. In fact, the oilers and maintenance men will take extra pride in their work and wipe off spots as soon as they notice them. Machinery and bearing supports of metal construction painted a dark color, can be treated in the same manner to show up oil waste and give a silent invitation to clean the machine.

•

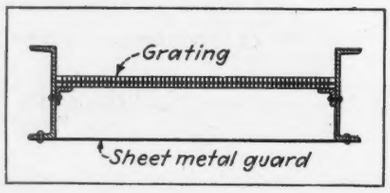
Guards Stop Objects Going Through Stairway Gratings

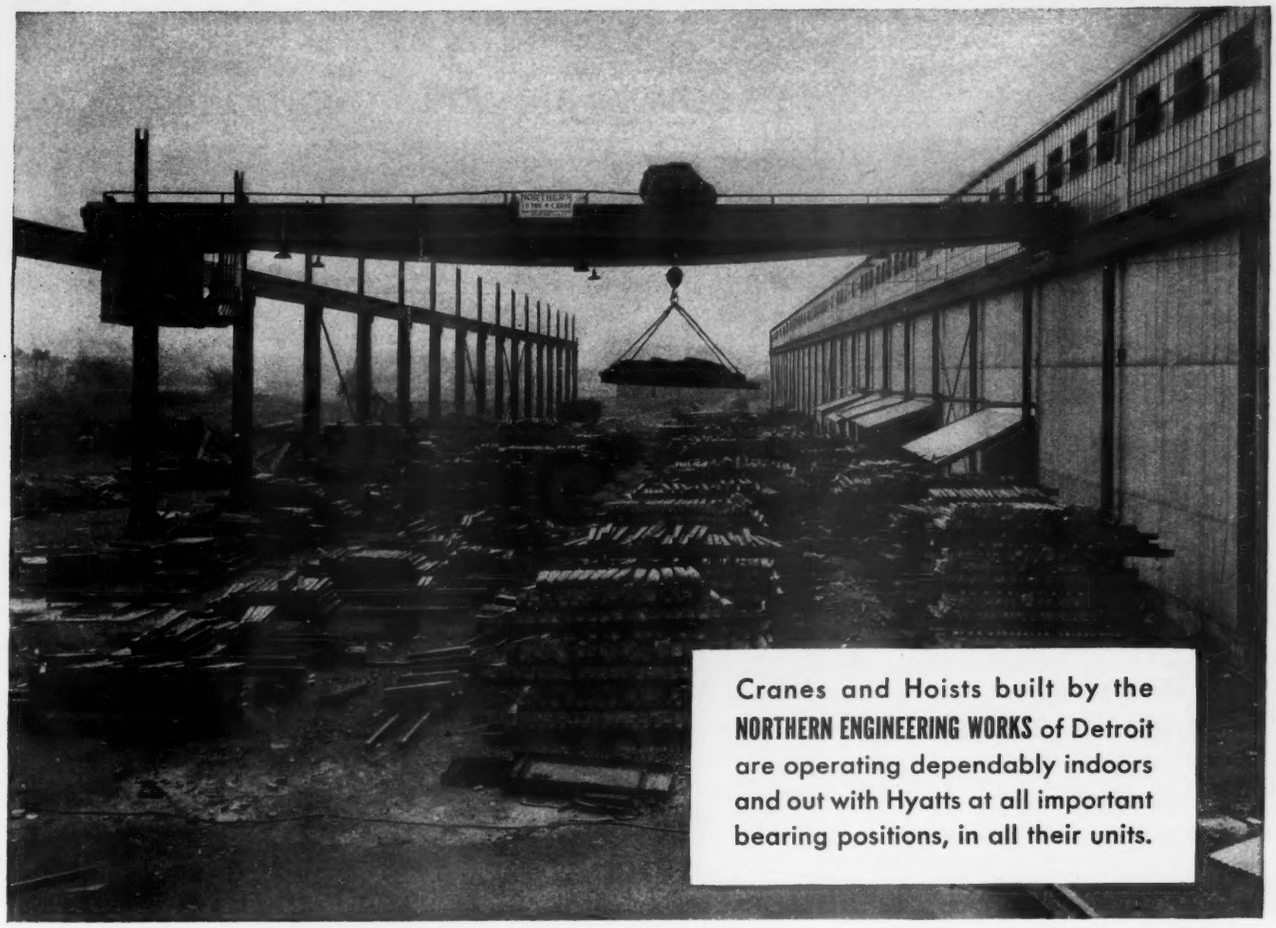
S. H. COLEMAN, *Bethesda, Md.*

Industrial stairways with steel grating steps and landings have several advantages. Among them are the reduction of slipping hazards, improved lighting and ventilation of the underlying floor area, and ease of cleaning.

One disadvantage is the possibility of objects falling through interstices in the grating and striking persons underneath.

This possibility can easily be pre-





Cranes and Hoists built by the **NORTHERN ENGINEERING WORKS** of Detroit are operating dependably indoors and out with Hyatts at all important bearing positions, in all their units.

Where Only the Fit Survive

HYATTS ARE USED when the going is tough...wherever friction, wear, and replacements must be avoided. With Hyatt Roller Bearings come *staying power* that prolongs machine life . . . *precision* that promotes better performance . . . *design* that guarantees greater mechanical efficiency.

Therefore, operating equipment of every kind is today more dependable and longer lived, because Hyatts help keep it fit for action. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Chicago, Pittsburgh, Detroit and San Francisco.

HYATT

ROLLER BEARINGS

QUIET

vented by fastening sheet-metal guards to the bottom flanges of the channels used to support the treads and landings, as shown in the sketch. In one large plant it is standard practice to install such guards wherever stairways are located above building entrance doors or other frequently travelled passageways.

•

Yellow lines painted on the floor in front of windows and fire doors help keep them from being blocked and creating a fire hazard.

•

A Few Big Orders Better Than Many Small Ones

JAMES WINSTON, *Production Manager*
Valley Engineering Company
San Bernardino, Calif.

Approximately 1,000 work orders per month pass over my desk on their way to the machine, foundry, structural, welding, pipe, carpenter and other shops of the maintenance and equipment division. One day I received an order for making six pieces of bent rail-ends for the third rail of our electric railroad. These bent rail-ends were used at intersections. In a few days I received an order for three more. In another week an order for a few more came through.

The set-up and the removal of tools on these small orders consumed as much time as the performance of the work. I went to see the superintendent of construction and told him about this, and asked him whether he needed any more bent rail-ends. He told me he did. Then I asked him if he would make a complete survey of the number of rail-ends he would require for this job. He said that he would. The following day I received a work order for 36 bent rail-ends, and we saved 45 per cent of the labor by making them in one lot.

After this I looked over our previous work orders and found a large number of repeats for such items as locomotive piston rings, hoop bolts, anchor bolts, wood staves, parts for crushers, cranes, and other equipment. I showed these to the superintendents of the departments where they originated and asked them whether they would place orders for three months' supply as indicated by these orders. They agreed to do this. Consequently we cut the labor cost of these items as much as 50 per cent and the waiting time for these parts was entirely eliminated.

POWER AND AIR CONDITIONING

No masks are used, for exhaust pulls dust down through grills on which work is placed

Down-Draft Exhaust Makes Grinding Room Dustless

SOURCE
The Monarch Machine Tool Company
Sidney, Ohio

By means of a down-draft ventilating system in our new plant addition castings are now being ground, spray painted, and sanded within a few feet of precision machining operations, without walls or partitions of any kind to separate departments.

There are 14 working stations in the installation—11 for small castings, 3 for lathe beds and other large castings. The top of each unit is a large grating, through which air is exhausted to pull away quickly the mist of rust, sand, and other fine particles. With the gratings for the large castings located on the floor and those for the small castings located at 16, 20, or 32-in. levels, the men are never in a position to inhale the dust or fumes, nor do they ever have to work in a bent-over position.

Units in the grinding section include a 2-wheel snagging grinder, a surface grinder for castings up to 4 feet square, and four grinding bucks, the largest 4 feet in diameter. In order to catch all grinding particles in the bucks these units are protected by sheet-metal guards.

In the small-castings paint department are two 4x8-ft. grills. Spray paint particles pulled down into these grills are carried away by means of water solution and eliminator packs located underground. The equipment in the sanding department includes four grills each 5 feet square. Here a water vapor is used in connection with the blower fan to eliminate the sand particles in the form of sludge.

All units are exhausted through the roof. The two painting outlets are carried 30 feet into the air to eliminate any possibility of the fumes re-entering the plant through the monitor windows. The total amount of air removed is 50,000 cu.ft. per min. at an average surface velocity of 200 ft. per minute.

The blower equipment consists of five fans located in a small room to the west. The piping system for the exhaust, compressed air, and paint lines is entirely under the floor.

•

Improved dust control in an Indiana factory has cut cost of occupational disease insurance premium $1,531 per year.

•

Fan Eliminates Condensation and Electrical Trouble

E. F. SIBLEY
Chief Power Plant Engineer
Seamless Rubber Company, Inc.
New Haven, Conn.

When the outdoor temperature was low we had trouble from condensation on the walls and ceiling of our switchboard room. The floor would be slippery and dangerous. Dripping water and condensation on the board itself caused burnouts in control wiring. It was only sheer luck that we did not

TOUGHER WHEN WET

Yet the NEW Mr. Thirsty Fibre is SOFT as ever!

TRADE MARK

THE new "Soft-Tuff" ScotTissue Towels have kept all their famous *softness,* yet they are far *stronger* in use. In fact, each towel can be used up to saturation!

As a result, they go farther, save money. In economy tests, the new "Soft-Tuff" ScotTissue Towels have substantially reduced previous ScotTissue Towel consumption.

Today, the new "Soft-Tuff" ScotTissue Towels are used in many great industrial plants, as well as thousands of offices, throughout the world. Their use has increased about *40%* in a few months! Let us demonstrate to you their amazing comfort and economy.

• • •

The Scott Washroom Advisory Service will help arrange washrooms comfortably, hygienically and at low cost. It will suggest ways to improve traffic conditions, reduce waste and increase employee and customer good will. Write for details! Scott Paper Co., Chester, Pa.

Copr., 1940, Scott Paper Co. Trade Marks "ScotTissue," "Thirsty Fibre" Reg. U. S. Pat. Office. Trade Mark "Soft-Tuff" Registration applied for.

Eliminate the Washroom "Double Standard"

IN THE PLANT, workers appreciate your providing clean, individual "Soft-Tuff" ScotTissue Towels. Since they are much stronger in use, one towel is sufficient. This means important savings.

IN THE OFFICE, executives enjoy the soft, luxurious texture of these new, improved towels. Moreover, they are designed to eliminate lint being left on the face or clothing.

NEW Soft-Tuff ScotTissue TOWELS

have any serious flashes from short circuited wiring before we conquered the trouble.

The switchboard room was located directly over a large pump room which in turn connected with a pipe tunnel. The inevitable leaks in a large steam system kept the humidity high and there was very little we could do about it without relocating the two rooms.

We solved our problem by installing a large propeller-type fan close to the ceiling. By keeping the air in circulation during the period when machines were being warmed up and started, we eliminated the condensation troubles.

ELECTRICAL UTILIZATION

Old Slot Insulation Easily Removed by Burning

SOURCE
The Linde Air Products Company
New York

Use of a decarbonizing blowpipe will reduce from hours to minutes the time required to remove old insulation from armature and rotor slots, before rewinding.

Of the simple equipment required for this operation the decarbonizing blowpipe is probably the only piece not already available in most shops. The function of this blowpipe is to provide an easily controlled stream of oxygen. As shown in the illustration it consists of a handle, valve, and long copper tube or stem. Other equipment needed is a small air-acetylene torch, a source of oxygen and acetylene, and suitable regulators and hose.

After the motor has been taken apart and the rotor or stator slots made easily accessible, the air-acetylene flame is used as a pilot to start combustion of the insulating material at the end of one of the slots. As the paper begins to burn the stem of the decarbonizing blowpipe is inserted in the slot and the blowpipe valve is opened. The air-acetylene torch is then withdrawn and the decarbonizing blowpipe is moved slowly along to the other end of the slot. Thus the combustion of the paper and other insulating material is supported and hastened by the oxygen stream directed onto it by the blowpipe.

Oxygen is supplied through a ¼-in. hose at a pressure of three pounds per square inch.

It has been found that slot-cleaning jobs that formerly took from four to eight hours can be done in a half hour or less by means of the blowpipe. The time required depends, of course, on size of the motor and condition of the insulating material. Motors ranging in size from ¾- to 3-hp. rating can be cleaned in about 20 minutes.

On some larger motors a heavily oxidizing flame produced by a standard welding blowpipe with a small tip also gives good results.

•

Simple Tests for Ratio of Potential Transformers

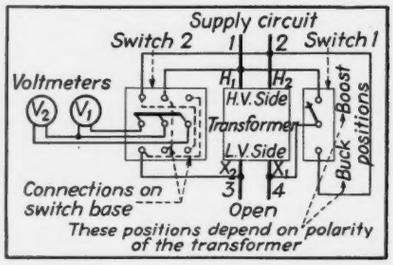
C. O. VON DANNENBERG, *Brooklyn, N. Y.*

Testing of potential transformers for ratio requires expensive equipment, if precise results are required. When only check tests are required, however, simple methods of testing may be employed which are sufficiently accurate for practical purposes. In addition to the ratio, the tests described will also show the relative polarity of the terminal connections.

The test consists in feeding a low voltage to the high-voltage winding of the transformer under test and taking readings with voltmeters connected as shown in the diagram. With switch *1*, one end of the low-voltage winding may be connected to either of the supply lines or to the high-voltage winding. Hence, the voltage in the low-voltage winding will be added to or subtracted from the supply voltage, depending upon the polarity of the terminals. By means of switch *2* simultaneous readings of the supply and the other voltage can be obtained.

If both switches are in the upper position and voltmeter V_1 reads lower than V_2, terminals H_1 and X_1 have the same polarity, so far as the direction of the induced voltage is concerned. If switch *1* is in the lower position, connecting leads H_2 and X_2, the voltage of V_1 with switch *2* in the upper position will be higher than V_2 and the transformer will have subtractive polarity. Usually polarity markings are placed on terminals of the same polarity.

With the connections shown readings of V_1 and V_2 are first taken with both switches in the upper position. Switch *2* is then thrown to the lower position and readings again taken. Reversing switch *2* changes the connections of voltmeter V_1 from the supply side, *1–2*, to the low-voltage side, *1–3*, and of V_2 from side *1–3* to *1–2*. This procedure gives two readings of the supply voltage and two of the boosted or bucked voltage on the voltmeters, and provides the average voltage used in calculating the ratio.



For ordinary work supply voltages of 115 and 230 volts are satisfactory. They permit 150- or 300-volt-scale meters to be used with transformers having ratios as low as 4 to 1.

With a 10-to-1 ratio transformer, a 115-volt supply, and both switches in the upper position, voltmeter V_1 will read 115 and V_2 approximately 126 volts. Hence, the ratio will be 115 ÷ (126–115), or approximately 10. With switch *1* in the lower position the readings would be 115 and approximately 104, giving a ratio of 115 ÷ (115–104), or approximately 10.

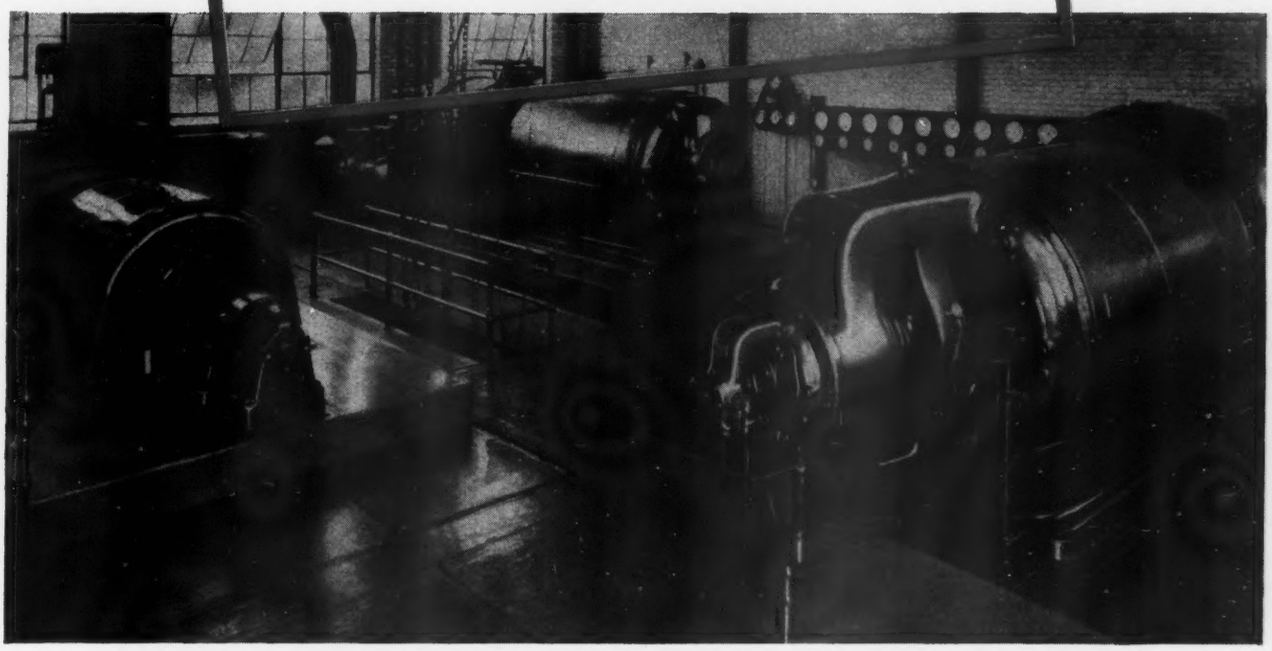
For accuracy two readings of each voltage should be obtained with switch *2* in both positions. The ratio will then be calculated as previously, except that we add the two voltages of *1–2* and *1–3* obtained with different voltmeters. For example, in the first case cited we would have:

$(115 + 115) \div [(126 + 126) - (115 + 115)] = 230 \div (252–230) = 10$, approximately.

In the foregoing no account has been taken of the difference in phase angle between primary (high voltage) and secondary (low voltage) voltage. This angular difference is exceedingly small in modern, standard-make transformers. If it is to be checked, values under different types of loading should be obtained either from a certified test or in other ways.

18 YEARS

Outstanding Performance



POWER PLANT at Ware Shoals, S. C. From left to right: 2000 K.W. G.E. Turbine installed in 1932; 3000 K.W. G.E. installed in 1927; 2000 K.W. G.E. installed in 1922. All lubricated since installation with *Texaco Regal Oil A* exclusively.

IN SERVICE 18 years, a G.E. Turbine in the Ware Shoals (S. C.) power plant* has given trouble-free performance, with oil lines always clean, governors always operating properly. Thirteen years ago a second G.E. Turbine went on the line . . . and in 1932 a third G.E. was started up.

Because of its outstanding performance in the first machine, all 3 of these turbines are lubricated with *TEXACO REGAL OIL A.*

Texaco Regal Oils are highly resistant to oxidation, emulsification, and sludging. They keep turbine lubricating systems clean, bearings at normal temperatures, wear at minimum. With average care, *Texaco Regal Oils* assure trouble-free lubrication for years.

Trained lubrication engineers will gladly cooperate in making savings with *Texaco Regal Oils* in your turbines. Phone the nearest of more than 2300 Texaco warehousing points in the 48 States, or write:

The Texas Company, 135 East 42nd St., New York, N. Y.

*Name on request.

Thousands of turbines on land and sea are more effectively lubricated with Texaco Regal Oils.

Texaco Dealers invite you to enjoy Fred Allen in the new full-hour program of The Texaco Star Theatre . . . with Kenny Baker, Al Goodman's Orchestra and a great cast. Every Wednesday Night, Columbia Network. 9:00 E.S.T., 8:00 C.S.T., 10:00 M.S.T., 9:00 P.S.T.

TEXACO

TEXACO Regal Oils

FOR TURBINE LUBRICATION

Electrical Control Troubles and Their Causes

J. H. HOPPER
Industrial Control Engineering Department
General Electric Company
Schenectady, N. Y.

PREVENTIVE MAINTENANCE, involving frequent inspection and prompt replacement or repair of worn or defective parts, will do a great deal towards keeping control troubles down to the minimum. Nevertheless, occasional failures occur in spite of all efforts to prevent them. The task of locating and repairing the trouble as quickly as possible is of prime importance. Equally important is the problem of applying the proper corrective measures to prevent the recurrence of failures or troubles of the same nature. This objective can be accomplished only by eliminating the causes of trouble as completely as possible.

In Tables I and II are given some of the basic causes of trouble with control equipment. It is assumed that the difficulty is not due primarily to improper design, defects in manufacture, or a generally worn-out condition.

Table I. Types of Control Troubles and Their Causes

BRAKES, DISK, A. C.

Coil Failure
- (*a*) Moisture
- (*b*) Overvoltage
- (*c*) High ambient temperature
- (*d*) Failure of magnet to seal in on pickup
- (*e*) Too-rapid duty cycle
- (*f*) Corrosive atmosphere
- (*g*) Chattering of magnet
- (*h*) Metallic dust
- (*i*) Mechanical overload (cannot pick up)
- (*j*) Mechanical underload (slamming, resulting in mechanical failure)

Excess Wear on Friction Surfaces
- (*a*) Abrasive dust
- (*b*) Heavy duty
- (*c*) High-inertia load
- (*d*) Excess temperature
- (*e*) Scarred wheels

Failure to Hold Load
- (*a*) Worn parts
- (*b*) Out of adjustment
- (*c*) Misapplication
- (*d*) Not using recommended replacing material

Failure to Release
- (*a*) Improper adjustment
- (*b*) Coil not energized
- (*c*) Mechanical binding
- (*d*) Low voltage or current
- (*e*) Coil open
- (*f*) Shorted turns

Failure to Set
- (*a*) Improper adjustment
- (*b*) Mechanical binding
- (*c*) Coil not deenergized
- (*d*) Worn parts

Miscellaneous Mechanical Troubles
- (*a*) Overvoltage
- (*b*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
- (*c*) Chattering
- (*d*) Abrasive dust

Noisy Magnet
- (*a*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
- (*b*) Improper adjustment (too much spring pressure or incorrect lever ratio)

BRAKES, DISK, D. C.

Coil Failure
- (*a*) Overvoltage
- (*b*) High ambient temperature
- (*c*) Wrong coil
- (*d*) Moisture
- (*e*) Corrosive atmosphere
- (*f*) Intermittent coil energized continuously
- (*g*) Holding resistor not cut in
- (*h*) Mechanical failure of coil

Excess Wear on Friction Surfaces
- (*a*) Abrasive dust
- (*b*) Heavy duty
- (*c*) High-inertia load
- (*d*) Excess temperature
- (*e*) Scarred wheels

Failure to Hold Load
- (*a*) Worn parts
- (*b*) Out of adjustment
- (*c*) Misapplication
- (*d*) Not using recommended replacing material

Failure to Release
- (*a*) Improper adjustment
- (*b*) Coil not energized
- (*c*) Mechanical binding
- (*d*) Low voltage or current
- (*e*) Coil open
- (*f*) Shorted turns

Failure to Set
- (*a*) Improper adjustment
- (*b*) Mechanical binding
- (*c*) Coil not deenergized
- (*d*) Worn parts

Miscellaneous Mechanical Troubles
- (*a*) Overvoltage
- (*b*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
- (*c*) Chattering
- (*d*) Abrasive dust

BRAKES, SHOE, A. C.

Broken Pole Shader
Heavy slamming caused by:
- (*a*) Overvoltage
- (*b*) Mechanical underload
- (*c*) Wrong coil
- (*d*) Low frequency

Coil Failure
- (*a*) Moisture
- (*b*) Overvoltage
- (*c*) High ambient temperature
- (*d*) Failure of magnet to seal in on pickup
- (*e*) Too-rapid duty cycle
- (*f*) Corrosive atmosphere
- (*g*) Chattering of magnet
- (*h*) Metallic dust
- (*i*) Mechanical overload (cannot pick up)

(CONTINUED ON PAGE 96)

STOP the FIRE with R-W AUTOMATIC Fire Door Equipment

FAHRENHEIT
160
Fusible link melts at 160°—doors close automatically!
RICHARDS WILCOX R·W AURORA
"Quality leaves its imprint"
International Fire Prevention Week October 6 to 12

Automatic closing . . . that's the certain protection afforded by R-W equipment. The doors *close themselves* at any temperature desired; they cannot fail! When closed, FyeR-Wall doors stop the passage of fire. Constructed with heavy corrugated galvanized sheets with thick sheet-asbestos between, yet they cost no more than tin-clad doors. No maintenance cost; and *guaranteed for 25 years!*

The label of the Underwriters Laboratories on this R-W equipment entitles you to 15% to 25% lower insurance rates. R-W Fire Door Equipment meets every conceivable condition; provides certain protection; brings tangible and important economies.

Consult an R-W engineer; write for catalog.

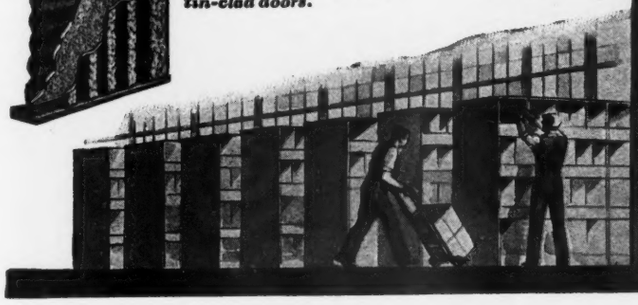
Richards-Wilcox Mfg. Co.

"A HANGER FOR ANY DOOR THAT SLIDES"
AURORA, ILLINOIS, U.S.A.

Branches: New York Chicago Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit Atlanta Pittsburgh Milwaukee Richards-Wilcox Canadian Co., Ltd., London, Ont., Montreal, Winnipeg

Note rigid construction of Fye-R-Wall doors with heavy steel frame. They cost no more than tin-clad doors.

1880
SIXTY YEARS
1940



Electrical Control Troubles and Their Causes

(CONTINUED FROM PAGE 94)

Table I. Types of Control Troubles and Their Causes

(*j*) Mechanical underload (slamming, resulting in mechanical failure)

Excess Wear on Friction Surfaces
(*a*) Abrasive dust
(*b*) Heavy duty
(*c*) High-inertia load
(*d*) Excess temperature
(*e*) Scarred wheels

Failure to Drop Out
(*a*) Mechanical binding
(*b*) Gummy substance on magnet faces
(*c*) Airgap in magnet destroyed
(*d*) Voltage not removed

Failure to Hold Load
(*a*) Worn parts
(*b*) Out of adjustment
(*c*) Misapplication
(*d*) Not using recommended replacing material

Failure to Pick Up
(*a*) Low voltage
(*b*) Coil open
(*c*) Mechanical binding
(*d*) Wrong coil
(*e*) Shorted turns
(*f*) Excessive magnet gap
(*g*) Mechanical overload

Failure to Release
(*a*) Improper adjustment
(*b*) Coil not energized
(*c*) Mechanical binding
(*d*) Low voltage or current
(*e*) Coil open
(*f*) Shorted turns

Failure to Set
(*a*) Improper adjustment
(*b*) Mechanical binding
(*c*) Coil not deenergized
(*d*) Worn parts

Miscellaneous Mechanical Troubles
(*a*) Overvoltage
(*b*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(*c*) Chattering
(*d*) Abrasive dust
(*e*) Underload

Noisy Magnet
(*a*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(*b*) Improper adjustment (too much spring pressure or incorrect lever ratio)
(*c*) Broken pole shader
(*d*) Magnet faces not true due to wear or mounting strains
(*e*) Dirt on magnet
(*f*) Low voltage
(*g*) Mechanical overload
(*h*) Load out of alignment

Wear on Magnet
(*a*) Overvoltage
(*b*) Underload
(*c*) Broken pole shader
(*d*) Wrong coil
(*e*) Chattering
(*f*) Load out of alignment

BRAKES, THRUSTOR OPERATED

Excess Wear on Friction Surfaces
(*a*) Abrasive dust
(*b*) Heavy duty
(*c*) High-inertia load
(*d*) Excess temperature
(*e*) Scarred wheels

Failure to Hold Load
(*a*) Worn parts
(*b*) Out of adjustment
(*c*) Misapplication
(*d*) Not using recommended replacing material

Failure to Release
(*a*) Improper adjustment
(*b*) Coil not energized
(*c*) Mechanical binding
(*d*) Low voltage or current
(*e*) Coil open
(*f*) Shorted turns

Failure to Set
(*a*) Improper adjustment
(*b*) Mechanical binding
(*c*) Coil not deenergized
(*d*) Worn parts

Short Life on Thrustor
(*a*) Abrasive dust
(*b*) Dirty oil
(*c*) Water in tank

BRAKES, SHOE, D. C.

Coil Failure
(*a*) Overvoltage
(*b*) High ambient temperature
(*c*) Wrong coil
(*d*) Moisture
(*e*) Corrosive atmosphere
(*f*) Intermittent coil energized continuously
(*g*) Holding resistor not cut in
(*h*) Mechanical failure of coil

Excess Wear on Friction Surfaces
(*a*) Abrasive dust
(*b*) Heavy duty
(*c*) High-inertia load
(*d*) Excess temperature
(*e*) Scarred wheels

Failure to Drop Out
(*a*) Mechanical binding
(*b*) Gummy substance on magnet faces
(*c*) Airgap in magnet destroyed
(*d*) Voltage not removed

Failure to Hold Load
(*a*) Worn parts
(*b*) Out of adjustment
(*c*) Misapplication
(*d*) Not using recommended replacing material

Failure to Pick Up
(*a*) Low voltage
(*b*) Coil open
(*c*) Mechanical binding
(*d*) Wrong coil
(*e*) Shorted turns
(*f*) Excessive magnet gap
(*g*) Mechanical overload

Failure to Release
(*a*) Improper adjustment
(*b*) Coil not energized
(*c*) Mechanical binding
(*d*) Low voltage or current
(*e*) Coil open
(*f*) Shorted turns

Failure to Set
(*a*) Improper adjustment
(*b*) Mechanical binding
(*c*) Coil not deenergized
(*d*) Worn parts

Miscellaneous Mechanical Troubles
(*a*) Overvoltage
(*b*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(*c*) Chattering
(*d*) Abrasive dust
(*e*) Underload

CAPACITORS

Breakdown
(*a*) Overload
(*b*) Overvoltage
(*c*) A.c. on d.c. capacitor
(*d*) Moisture
(*e*) High temperature
(*f*) Mechanical damage
(*g*) Continuous voltage on intermittent types

CONTACTORS, A. C.

A. C. Operated

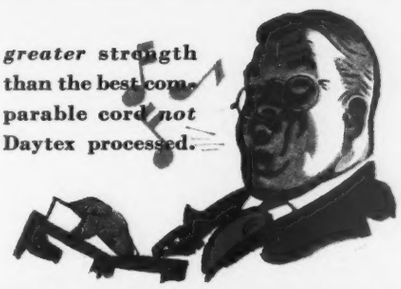
Blowout Coil Overheats
(*a*) Overcurrent
(*b*) Wrong-sized coil
(*c*) Loose connection on stud or tip
(*d*) Tip heating (see Table II)

Broken Flexible Shunt
(*a*) Large number of operations
(*b*) Improper installation (check instructions)
(*c*) Extreme corrosive conditions
(*d*) Burned from arcing

(TO BE CONTINUED)

Because Dayton V-Belts with Daytex Cord in their neutral axis section have *less* stretch, they are cooler running and they stand up *longer* under the strain of constant high speed flexing. And that means that your power dollar stretches farther to give you lower cost per-month-of-service.

Wherever power is used you will find proof of the fact that Daytex Cord *does* have *less* stretch, *longer* life and *greater* strength than the best comparable cord *not* Daytex processed.

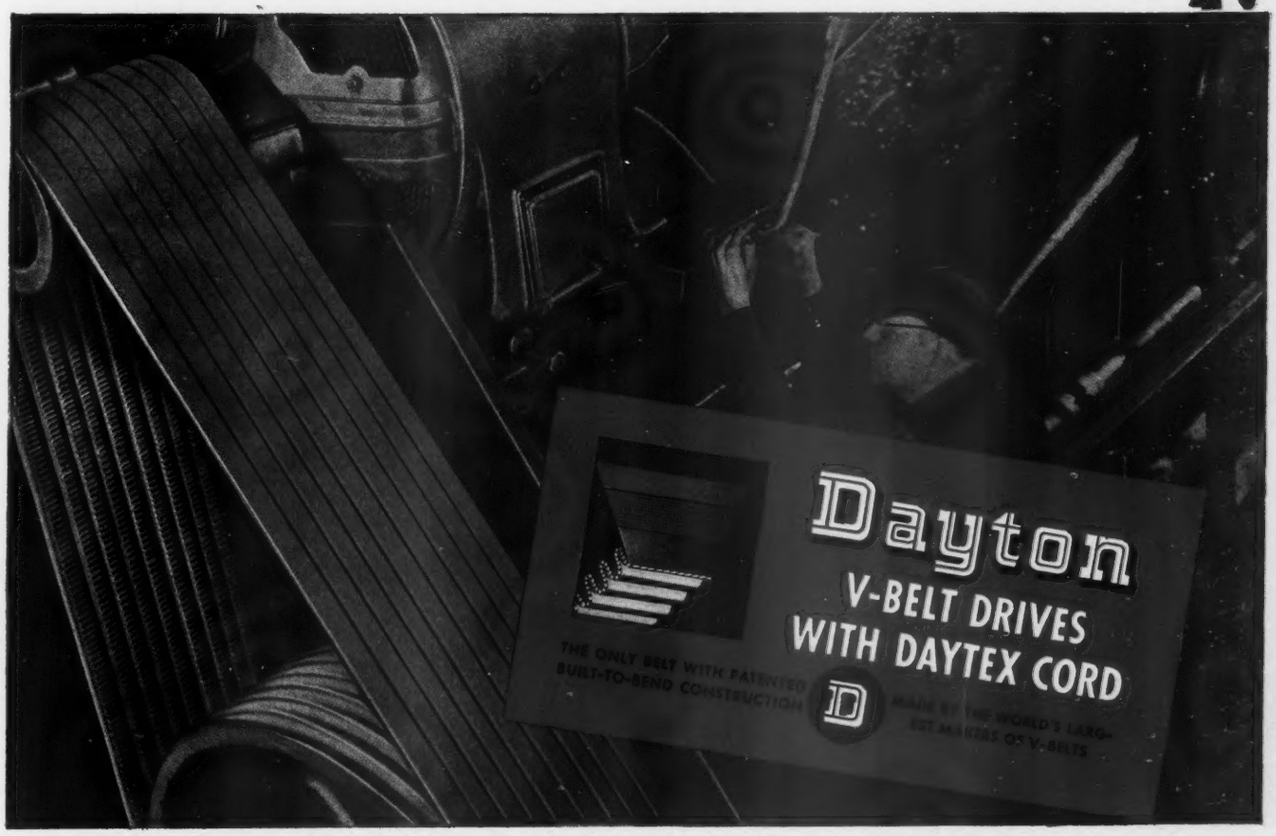


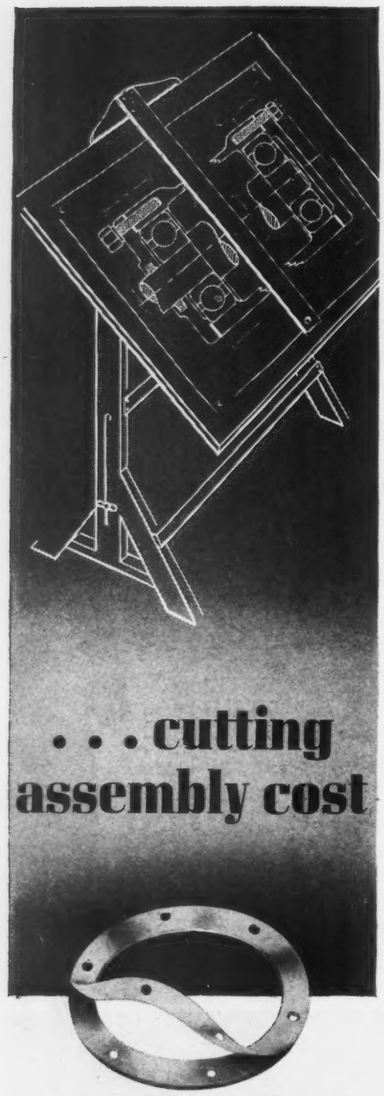
In thousands of field applications—in all climates and under all conditions, cooler running Dayton V-Belts deliver more output at less cost. What's more, they save time, machinery—and reduce adjustments to a negligible minimum.

Dayton V-Belts are outstanding in basic design because they are the only belt with patented built-to-bend construction. They work on short centers—they save space—maintain machine speed and prevent power waste. Ask your local Dayton distributor for catalogs, data and "The Picture Story of Daytex Cord."

* * *

THE DAYTON RUBBER MANUFACTURING CO.
DAYTON, OHIO


Dayton
V-BELT DRIVES
WITH DAYTEX CORD
THE ONLY BELT WITH PATENTED BUILT-TO-BEND CONSTRUCTION
MADE BY THE WORLD'S LARGEST MAKERS OF V-BELTS



. . . cutting assembly cost

to help **sell** *it*

For quick precision assembly, simply *peel* .002 or .003 inch precision gage laminations from the solid Laminum shim. Provide easy, accurate adjustment . . . to fitted mechanical parts such as bearing assemblies, sliding fits, gear clusters and the like. Help meet *your* competition through lower assembly costs. • *Shims cut to your order. Stock shim materials obtainable from mill supply distributors.*

Laminated Shim Co., Inc.
54 Union St., Glenbrook, Conn.

Write for file-folder of shim application photos—with Laminum sample.

LAMINUM

THE SOLID SHIM THAT peels FOR ADJUSTMENT

A-1169

You Want to Know

more about the items mentioned on this page.
Letters to the addresses given will bring information

• "JOB TRAINING for National Defense" details organization and operation of the plan, to solve unemployment, that was launched in Connecticut in November, 1939, by private businessmen and manufacturers with the cooperation of the state government. Carl A. Gray, Chairman, The Governor's Commission to Study Employment, State Capitol, Hartford, Conn.

• PLASTIC COATING applied to new or old concrete floor seems impervious to truck wear, moisture in the floor, alkalis in the cement, oil or gasoline drippings. One coat is sufficient, for it is said to be as thick as three or four coats of regular paint. Three colors. The Harrington Paint Co., Inc., 1630 Collamer Ave., East Cleveland, Ohio.

• FIRST AID STRETCHER is flexible type so that it can be carried through narrow, crooked passageways, up or down ladders or circular stairways. Zipper runs length of the stretcher so that stretcher can be slipped out from under patient after placing him on cot. Industrial Products Co., 800 West Somerset St., Philadelphia.

• NEOPRENE, the synthetic rubber-like material, now has its story told in a sound motion picture. The 20-min. film shows how neoprene is made, explains its chemical formula by means of animated cartoons, shows tests of the material, and pictures applications of products made from it. Bookings may be arranged through Rubber Chemicals Division, E. I. du Pont de Nemours & Co., Wilmington, Del.

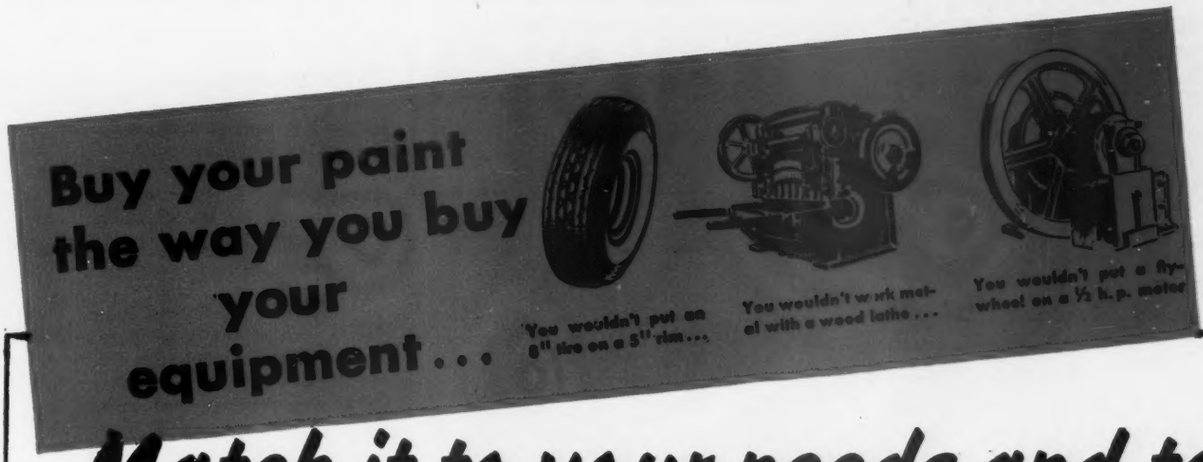
• STAMP PAD INK is said to give fast-drying waterproof impressions on any material but waxed paper, including lithographed, varnished, and glazed surfaces. Comes in five colors. Louis Melind Co., 362 West Chicago Ave., Chicago.

• PREPARATION of American industry for a wartime emergency is discussed in "Educational Orders for Peace-Time Munitions Production." 25c. American Management Association, 330 West 42d St., New York.

• CASE HISTORY of how business men in Pennsylvania made real jobs in private business to relieve unemployment, make business better, lessen relief, lower taxes is set forth in "Mobilizing Jobs," a pamphlet summarizing three volumes on the subject. The Curtis Publishing Co., Independence Square, Philadelphia.

• IRON POWDER now being produced by the Metals Refining Company, Division of The Glidden Co., Hammond, Ind., is

DUSTPAN ON WHEELS is this clean-up cart which can be maneuvered in small places too tight for a wheelbarrow. Mounted on ball-bearing, rubber-tired wheels, it has a capacity of over one bushel. Palmer Shile Co., 7100 West Jefferson Ave., Detroit


Buy your paint the way you buy your equipment . . .
You wouldn't put an 8" tire on a 5" rim . . .
You wouldn't work metal with a wood lathe . . .
You wouldn't put a flywheel on a ½ h. p. motor

Match it to your needs and to your pocketbook

Now you can do it with these three outstanding Barreled Sunlight Whites

. . . each the finest available within its price range . . . one best fitted to meet your specific need

DID you know that Barreled Sunlight costs no more than ordinary good white paint? That from the THREE recently developed Barreled Sunlight Whites you can get exactly the paint you need for the finest possible job at a lower cost?

Those are facts. Check them with your Barreled Sunlight Representative . . . but don't stop with an office discussion. *Let him inspect your plant.* He'll show you how the right Barreled Sunlight in the right place brings worth-while savings . . . PLUS a whiter, longer lasting job. Send for free booklet—"The Right Paint for Your Plant." U. S. Gutta Percha Paint Co., 2-J Dudley St., Providence, R. I.

UNMATCHED FOR 40 YEARS, **Barreled Sunlight *stays* first in the white-paint field because of never-ending research. Working with the secret Rice Process—*which cannot be copied*—Barreled Sunlight chemists have made Barreled Sunlight whiter and whiter, and given it far greater white retention, flowing, spreading and hiding powers. And because of this same research, you can buy Barreled Sunlight for the same price you'd pay for an ordinary good white paint.**

BARRELED SUNLIGHT

SPECIALISTS IN WHITE PAINT FOR INDUSTRY FOR 40 YEARS

The job was simplified and quick, low-cost installation gained in this limited space by using ARMCO Spiral Welded Pipe with "tailor-made" fittings.

MAKE THIS "Economy Check" ON NEW PIPE LINES

Here's a good way to make an "economy check" when you need new piping. Just submit the plans to ARMCO. Chances are you'll be pleasantly surprised at the savings you can make by re-designing with ARMCO Spiral Welded Pipe.

For one thing, ARMCO's custom-built method of fabricating pipe saves hours of tedious assembly. With fittings welded to straight pipe runs even the most complicated jobs fit like a tailor-made suit. Then too material costs are low when you use ARMCO Pipe. The shop-fabricated fittings eliminate at least one pair of flanges at every bend. Here savings up to 30% are not unusual. And maintenance will be trivial. Fewer flanges naturally mean less chance for costly leaks.

Simplify that next job by using ARMCO Spiral Welded Pipe. Sizes from 6 to 36 inches, wall thicknesses from 7/64 to 1/2 inch, with optional coatings and linings. Write for complete facts. The American Rolling Mill Company, Pipe Sales Division, 1951 Curtis Street, Middletown, Ohio.

ARMCO

Armco

SPIRAL WELDED PIPE

said to be the equivalent of Swedish iron powder, the American supply of which has been cut off by the war.

• NAIL HOLDS like a screw. Sharp annular grooves provide the gripping power, for as the nail penetrates the wood it spreads the fibers into tiny wedges which lock into the grooves. No pilot hole is required. Nail is made of Monel, is rustproof even in salt water, features a heavy head. Independent Nail & Packing Co., Bridgewater, Mass.

• THE AMERICAN labor supply is inferior to that of any possible combinations of hostile powers but our mechanization compensates for our disadvantage in manpower and working hours, according to a study of American security in terms of our ability to produce defense materials. Farrel-Birmingham Co., Inc., Ansonia, Conn.

• IMPROVED METHOD of electro-cleaning buffed brass, bronze, and other copper alloys before bright nickel plating is said to eliminate necessity for cyanide dip and copper strike before plating. Oakite Products, Inc., 22 Thames St., New York.

• "MATERIAL HANDLING HANDBOOK," available without cost to production executives and engineers, is intended as a guide for analysis of materials handling problems. Its content includes materials handling management, organizing an industrial truck handling system, practical truck engineering. The Industrial Truck Statistical Association, 208 South La Salle St., Chicago.

• NEW COMPOUND called Slip-Not, when spread on slippery floors, "takes up" the grease, oil, water and thereby insures safe footing and prevents falls. Safety Division, Sugar Beet Products Co., 302 Waller St., Saginaw, Mich.

• ORGANIZATION established and maintained through the cooperation and association of realty brokers and salesmen offers a central listing bureau service for vacant industrial property available throughout the country. Booklet. "How to Take the 'Chase' Out of PurChase," tells about the organization. National Industrial & Commercial Realty Exchange, Inc., 401 Broadway, New York.

• ELECTRIC COIL BOBBIN, made of insulating paper spirally wound on a steel die, provides manufacturers of small motors, relays, solenoids, photoelectric devices with a coil smaller than the layer-wound type. The significance of this development is claimed to rest in the heat factor problem; it permits use of a larger-gage wire in the same amount of space. Round, square, or rectangular shapes. Precision Paper Tube Co., 2033 Charleston St., Chicago.

• PAMPHLET, "Productivity, Wages, and National Income," discussing the fundamental issues involved in technological and economic progress, is a digest of The Brookings Institution book of the same title announced in May "Books" section. Maurice and Laura Falk Foundation, Farmers Bank Bldg., Pittsburgh.

NOW YOU CAN PAINT CONCRETE BEFORE IT'S THOROUGHLY DRY

PAINT MADE WITH PARLON*
DRIES QUICKLY ON DAMP SURFACES
RESISTS DESTRUCTIVE CHEMICAL ACTION OF ALKALIES AND MOISTURE

IF you're enlarging your plant, or building a new one, use paint made with a Parlon base on concrete, plaster, stucco, and cement-asbestos materials. You'll start operating sooner, and the paint will last longer. This is because Parlon-base paint can be applied without waiting for the surface to dry thoroughly; and because this paint dries with great speed, even in the presence of dampness. Moreover, it gives real protection, for it resists the chemical action of alkalies combined with moisture, which shortens the life of most paint on concrete.

FOR OLD CONSTRUCTION, TOO!

Used on old construction, too, Parlon-base paint will dry rapidly, save maintenance costs, clean easily, and improve appearance.

Progressive manufacturers of protective finishes make Parlon-base paint. Probably your supplier does. Mail the coupon for the complete story of this revolutionary new material that will save your time and your money.

Cellulose Products Department
HERCULES POWDER COMPANY
Incorporated
WILMINGTON, DELAWARE

GET YOUR COPY OF THIS BOOK
MAIL THE COUPON NOW

Cellulose Products Department
Hercules Powder Company
905 Market St., Wilmington, Del.

Please send more information about PARLON-base paints.

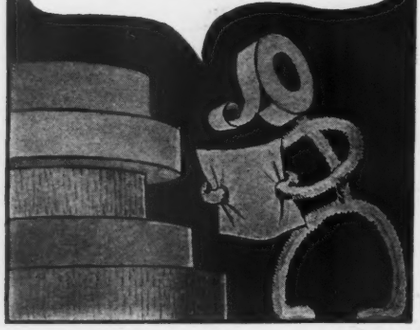
Attention of.....

Company.....

Address.....

GGG-10

STUDY THE *FACTS ABOUT INDUSTRIAL ADHESIVE TAPES



The great variety of uses of adhesive tapes, too numerous to mention in this space, are increasing efficiency and profits in more than 20 leading industries.

This famous line of pressure sensitive tapes is ready to prove its exceptional qualities by serving *your* industry.

PERMACEL
The Paper Backed Tape

JONFLEX
Fine Cloth Tape

INDUSTRIAL
Coarse Cloth Tape

UTILITAPE
Waterproof Cloth Tape in Standard Colors

ELECTAPE
With Flexible Bakelite Coating

METACEL
Metal Foil Backed Tape

TEXCEL
The Cellophane Tape

•

Samples on request

[*Send for the facts on how these tapes can be profitably used in your industry—without obligation.]

INDUSTRIAL TAPE CORPORATION
NEW BRUNSWICK, N. J.

What's New in Equipment

Intercommunicating System

Amplicall intercommunicating system with W-424 master station can be had from a two-station unit to as many as 84 stations. A feature named the "mute"

permits combining master stations and remote stations on same system without cross-talk between masters; master stations remain soundless except during conversation. Other features include individual locking-type, illuminated pushbuttons; balanced line circuit; tubes of low power consumption; and incoming and outgoing volume controls on each unit. The W-424 unit is also available with an earphone attachment. The Webster Co., 5622 Bloomingdale Ave., Chicago.

Regulator

Type FF Twin-Stage Regulator has a first stage adjustable to various pressures for different operations. After selected pressure is set, the delivery stage may be adjusted to any working pressure up to 200 lb., or more if specified. Outstanding feature is a unitary valve assembly used in both stages. It has four parts—small body, stainless steel spring, stainless steel ball, vulcanite seat—operated by a monel metal pin. Seating is with instead of against pressure. Each stage has a loose replaceable diaphragm and removable and inter-changeable inlets adaptable to any tank or line connection for any type of gas. Non-corrosive cylindrical filter screens enclose seat units for protection from dirt. The first stage is available separately for use with most any regulator to convert it to two-stage control. The Alexander Milburn Co., 1493 West Baltimore St., Baltimore.

Electric Etcher

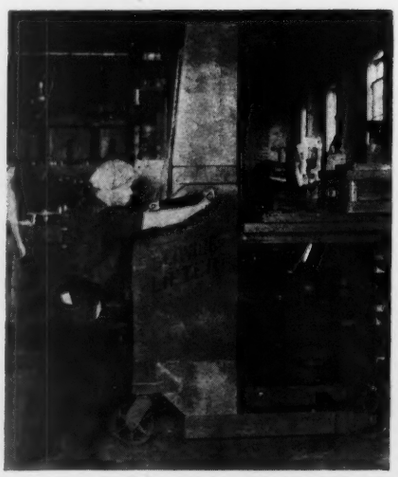
No. 13 Universal electric etcher has etcher tool and cords, switch and indicator lamp all under cover. Small objects are etched right on the work-plate which makes up part of the case, while a ground clamp is furnished for larger objects. Etching heats are 120, 240, 420 and 700 watts; the red indicator lamp burns brighter as hotter heats are turned on. Standard unit is for 110-volt, 60-cycle current, but other voltages and frequencies are available. Over-all size is 7¼x5⅛x8½ in.; weight complete is 16 pounds. Can be used for marking tools, parts, dies, bearings, saws, drills, products in production, and finished parts. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Water-Type Cooling Surface

Series W Surface is claimed to solve the problem of insuring water drainage in continuous or cleanable tube surfaces to a point where subsequent exposure of surface to cold air will not cause damage from freezing. By combining the effect of pitch (each tube is pitched) and the use of a special drain header, or headers, to relieve the trapped ends, this cooling surface has been given the feature of drainability; depending on the number of rows in the section, one, two, or three drain headers are incorporated. The surface is intended for air-cooling and dehumidifying (with cold water), or for air heating (with hot water). John J. Nesbitt, Inc., Holmesburg, Philadelphia.

Die-Handling Lifter

Portable lifter combines three die-handling operations—dies can be taken from or replaced in the storage shelf, transported from storage to press, and placed in or removed from the punch press. In taking dies from storage the lifter is wheeled up to the rack and the platform elevated to the proper level. A steel cable,



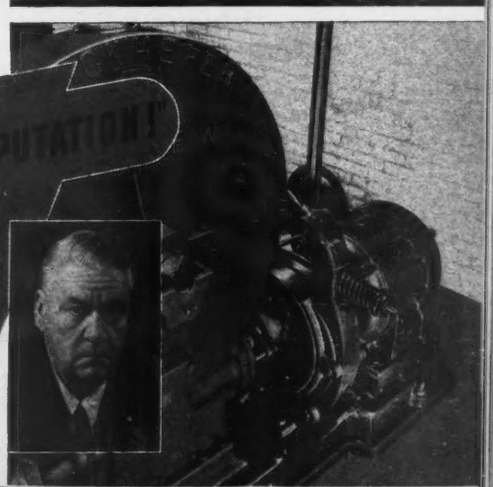
WANT THIS KIND OF MOTOR PERFORMANCE IN YOUR PLANT?

8½ YEAR REPAIR BILL—$000.00!

In this Cincinnati factory, 119 Allis-Chalmers Lo-Maintenance Motors have gone more than 8½ years without one cent spent for repairs . . . typical of Lo-Maintenance money-saving performance.

5 YEARS ON SUICIDE ROW!

Not a pretty picture! But this Lo-Maintenance Motor was running perfectly five years after it was installed on "Suicide Row" in this chemical plant, where adverse operating conditions wrecked other motors in 30 to 90 days!



"HELP PROTECT OUR REPUTATION!"

"Allis-Chalmers Lo-Maintenance Motors help us protect our reputation as builders of elevators that won't break down"—says E. F. Kleckhefer, vice-president, A. Kleckhefer Elevator Company.

Read These Interesting True Case Histories of How Allis-Chalmers Lo-Maintenance Motors are Providing Long-Life . . . Low-Cost Motor Service to Industry!

GET THIS type of up-to-date motor performance in your plant . . . and assure yourself long motor life plus low maintenance . . . with Allis-Chalmers Lo-Maintenance Motors.

For, in Lo-Maintenance Motors, you get such "full-measure" features as—distortionless, twistless stator . . . indestructible, removable rotor . . . high carbon steel frame . . . no skimping anywhere on materials or workmanship!

These are important features . . . designed to give you motor performance that is more than just a rated horsepower. Let the engineer in the district office near you explain them to you. Call him . . . today. Or write Allis-Chalmers, Milwaukee.

A 1241

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

GEARED FOR HIGH-SPEED, LOW-COST FINISHING WITH MODERN DEVILBISS SPRAY EQUIPMENT

DEVILBISS FINISHING EQUIPMENT

•

Complete Product-Finishing Systems
Spray Guns Material Containers
Paint Circulating Systems

•

Specialized Hose for Air and Fluids
Air and Fluid Regulators

•

Air Compressors

•

Cleaners Strippers Dusters
Handling Devices Accessories

•

Spray Booths Exhaust Fans Lights

•

Automatic Spray Coating Machines

•

Maintenance Painting Spray Outfits

• You're looking head-on into a modern, fast-action DeVilbiss product finishing line. It may not be the type for you but, like all DeVilbiss Spray Systems, it fits its job hand-in-glove.

The DeVilbiss line of Spray-Finishing Equipment is modern and complete. From it you may select those items which will give you a system exactly suited to your finishing operations—More than 30 spray gun models and hundreds of nozzle combinations for every known finishing material and operating condition — Material Containers from tiny 2 ounce glass cups to 120 gallon metal tanks—Air Purifiers and Regulators for the smallest touch-up to the largest production gun—Hose of every type for all air or fluid needs — Air Compressors that cover all requirements—Exhaust Equipment from bench booths to huge canopies and of dry or water wash types—Accessories such as dusters, hose connections, valves, fittings, regulators, lamps, fans, respirators and agitators, that round out those details of equipment necessary to every finishing room.

Check up on your product finishing operations. Call a DeVilbiss spray specialist to help you gear your plant for high speed, low-cost finishing.

THE DEVILBISS COMPANY, TOLEDO, OHIO
Canadian Plant: WINDSOR, ONTARIO

DE VILBISS SPRAY SYSTEMS

running from a winch inside the frame, is pulled out and attached to the die with a nut and bolt. The operator, standing on the floor, turns a crank which pulls the die from the shelf to the lifter's roller platform and the platform is lowered to convenient carrying position. Unit is powered with hand-operated lifting unit with two lifting speeds. Capacity of 4,000 lb.; over-all height, 8 ft. Worm gear safety hinge permits folding over top half of machine to pass through doorways. Platform measures 36 in. out from uprights by 30 in. wide, and on it is placed an auxiliary 30x30-in. roller platform. The Service Caster and Truck Co., Albion, Mich.

Unbreakable Loose Pulley Oiler

Oiler, for slow and high-speed applications without flooding, employs three principles of operation. The copper tube transmits heat of pulley hub to oil reservoir to produce quick thermal action, the wire reinforced wick feeds oil by capillary action, and the oil is dropped by gravity on the bearings. Available in one and two-oz. capacities with $\frac{1}{8}$ or $\frac{1}{4}$-in. pipe-thread fittings. Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee.

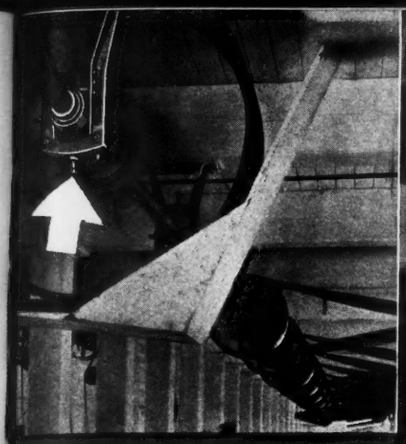
Reversible Wrenches

Three types for applying and removing nuts. Each employs a slow-speed rotary motor, has no gears or resilient member in the driving unit, is light in weight and short in over-all length. Type CP 344-R has bolt-size capacity of $\frac{3}{8}$ in., CP 349-R has bolt-size capacity of $\frac{1}{2}$ in., CP 360-R

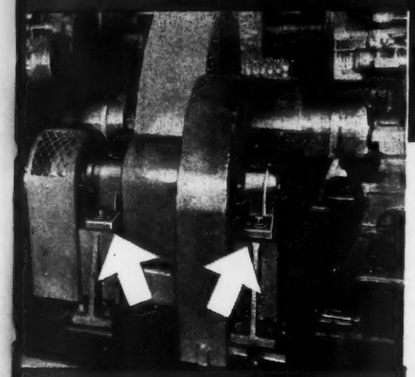
has bolt-size capacity of $\frac{3}{4}$ inch. Standard equipment for CP 344-R includes a hexagon socket for nuts $\frac{3}{8}$ in. across flats, 8 ft. $\frac{1}{16}$ in. air hose and fittings; for CP 349-R—hexagon socket for nuts $\frac{13}{16}$ in. across flats, 8 ft. $\frac{1}{16}$ in. air hose and fittings, suspension bail; for CP 360-R—hexagon socket for nuts $1\frac{1}{16}$ in. across flats, 8 ft. $\frac{1}{16}$ in. air hose and fittings, suspension bail. Similar in construction, the wrenches vary in size and weight. Chicago Pneumatic Tool Co., 6 East 44th St., New York.

Engine Safety Cutout

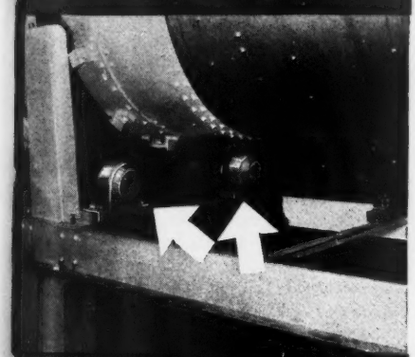
Designed to protect stationary internal combustion engines by interrupting their operation if the lubricating oil pressure drops hazardously low or if the cooling water temperature rises too high. Valu-



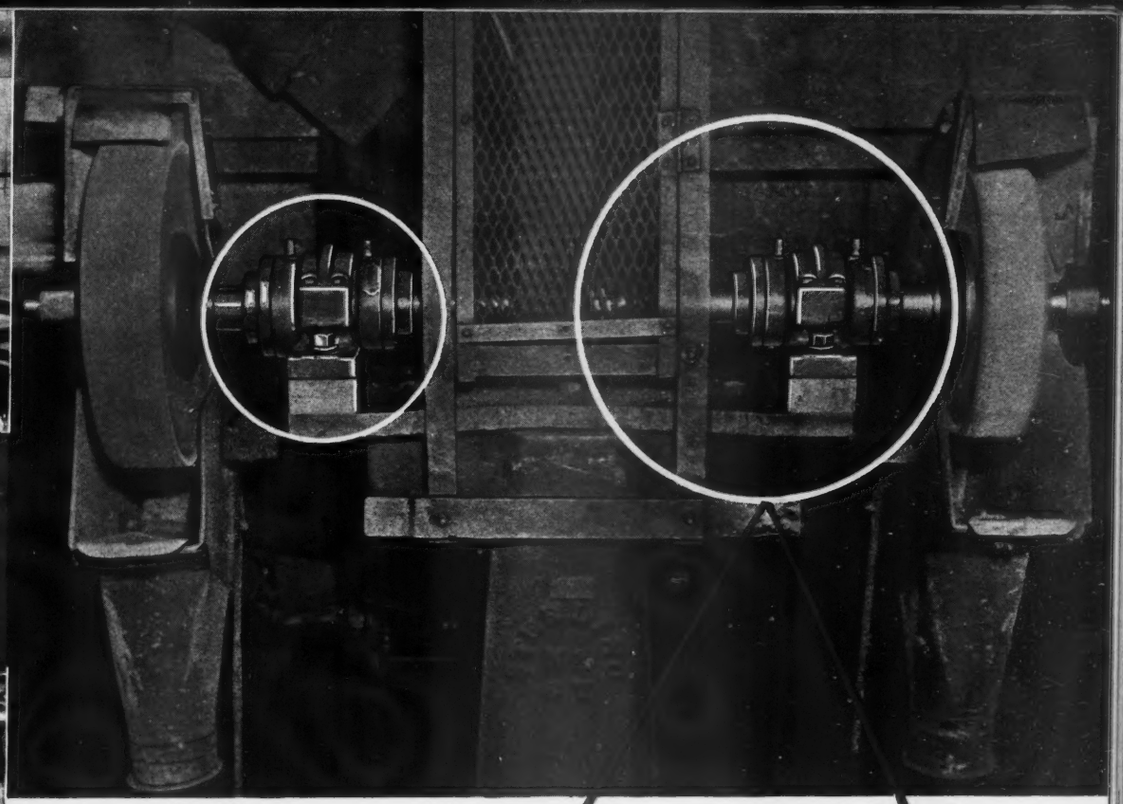
An Additional Machine was run from this "loaded" lineshaft after Fafnir Double Hanger Boxes were substituted for plain bearings. Oil drip and frequent oiling were eliminated.



Heavy Impacts of a rolling mill don't faze these Fafnir Pillow Blocks. They support its vital pinion drive, reduce friction and maintenance.



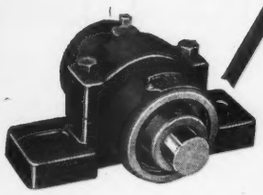
Power Bill for this large rotary dryer was cut in half when Fafnir Pillow Blocks replaced its plain bearings. Look through your plant for "turning points"!



Turning Points

TO INCREASED PRODUCTION

It's like finding money to discover that your present power, your present lineshafts, even your present machines will deliver more production when Fafnir Transmission Units are substituted for plain bearings. Take the case of the grinding head shown above: Due to wheel wobble from worn plain bearings, only one man could use it at a time. Shaft speed was limited to 1400, due to vibration, drag and belt slippage. After easily-mounted Fafnir Ball Bearing Pillow Blocks were installed (total changeover cost, $50), shaft speed climbed to 1800, and production was doubled because two men could use the grinder at once. Monthly rebabbiting, and oiling twice an hour gave way to greasing every three months.



No other ball bearing units could have made this turning point to increased production so easy to attain. Fafnirs alone offer the simplified installation made possible by the Fafnir Wide Inner Ring Bearing with Self-Locking Collar . . . no machining, adapters, shaft shoulders, or locknuts required. Fafnirs alone offer the long-life Balanced Design – deeper races, larger balls. Fafnir offers every type and size of radial and thrust bearing, precision bearing, self-aligning bearing, sealed bearing and housed transmission unit to provide the most complete line in America. Write for the "Ten Minute Story" of easy Fafnir modernization. Distributor stocks in principal cities. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR

Ball Bearings

THE BALANCED LINE · MOST COMPLETE IN AMERICA

Now—MORE LIGHT FOR YOUR MONEY *in Industrial Plants!*

We're down to brass tacks in getting the utmost lighting efficiency out of these new fluorescent lamps. New fixtures, designed for a variety of industrial locations, enable you to select exactly the right "daylight" illumination for each particular job. Porcelain enameled finishes assure highest factor of reflection, long life, and easy maintenance. Installation is simpler, too. All Goodrich Fluorescent Fixtures are furnished complete with ballast equipment, replaceable starters and adjustable brackets for chain or conduit mounting.

GOODRICH FLUORESCENT FIXTURES

THE OLYMPIAN—an R.L.M. closed-end fluorescent fixture; provides a higher degree of light control. Reflector and hood are separable. Uses two 48" fluorescent lamps. May be adjusted to any angle. Catalog sheets are available on the complete line of Goodrich Fluorescent Fixtures. Your copies sent upon request.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH ELECTRIC COMPANY

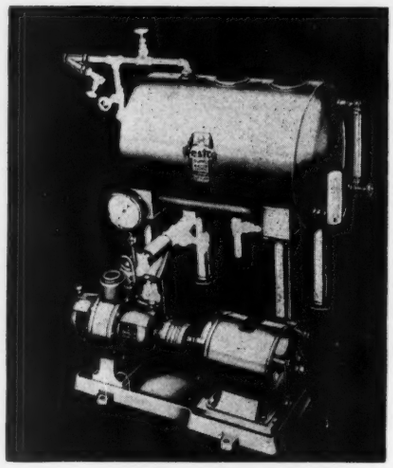
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.

able where engines operate for long periods of time unattended. Two models: P607A with manual reset; P607B without manual reset button for use on motors with automatic starting equipment where means is provided to shunt the circuit around the cutout until motor starts and oil pressure rises. Features: Applicable to engines with distributor-type ignition, magneto-type ignition, diesel engines, small 4x$\frac{1}{2}$-in. temperature element capsule which can be inserted in any $\frac{1}{2}$-in. pipe tapping in the block; no separable well to install; special packing gland furnished; mercury switch handles switching action. Dimensions: 6$\frac{3}{8}$ in. high, 5$\frac{9}{16}$ in. wide, 2$\frac{11}{16}$ in. deep. Minneapolis-Honeywell Regulator Co., 2950 Fourth Ave., South, Minneapolis.

Boiler Feed Systems

Planned for boilers up to 750 hp. and 200 lb. pressure. Said to return automatically all condensate to boiler from high and low-pressure equipment, to add make-up water as needed to compensate for loss of live steam, to maintain a uniform water level in boiler, to keep return lines constantly open, to eliminate back pressure on return lines. Each system is equipped with a turbine-type pump having renew-



able liners. The automatic boiler water level control starts and stops the boiler feed pump to maintain water level in the boiler within a $\frac{3}{4}$-in. range, cuts off burner or stoker if water in boiler should reach a dangerously low level, can be wired to sound an alarm when low cut-off point is reached, is fitted with Monel float, has specially constructed bellows to eliminate packing. Additional equipment includes receiver, stand, thermometer, gage, make-up valve, and strainers. Micro-Westco, Inc., 108 State St., Bettendorf, Iowa.

Water Preparation

Method of controlling distribution and flow of water in a zeolite softener, the Double Check Strainer System, has been developed to prevent loss of zeolite, to obtain better water distribution thereby cleaning the bed more thoroughly, to increase the capacity of a water softener, to permit use of a larger amount of zeolite in a softener of given size. (Said to increase capacity of given size softener

Name IT and You Can Have IT

Crocker-Wheeler
ALTERNATING CURRENT
Motors

TRADE MARK

REG. U. S. PAT. OFF.

FOR many years motor manufacturers have been very, very accommodating. They have said to their customers: "Just tell us what you want in the way of a motor, and we will build it for you."

Crocker-Wheeler has been no exception. In fact, it almost seems as though there could not be a motor that had not already been built. And so we say: If YOU have a motor problem, why not tell us about it? It may be that we have already designed a motor that will suit your needs exactly. Or better still, we may be able to show you how you can use a standard motor—and save money.

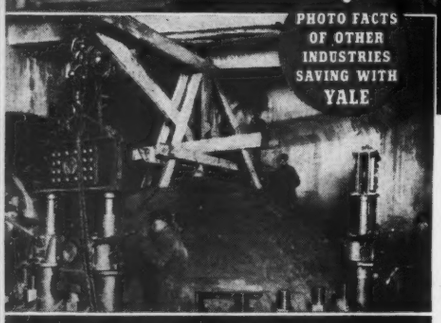
Write today for your copy of the new 6-page *Motor Price List* giving prices, weights and dimensions of standard motors in sizes up to 75 horsepower.

CROCKER-WHEELER

CROCKER-WHEELER ELECTRIC MFG. CO., AMPERE, NEW JERSEY

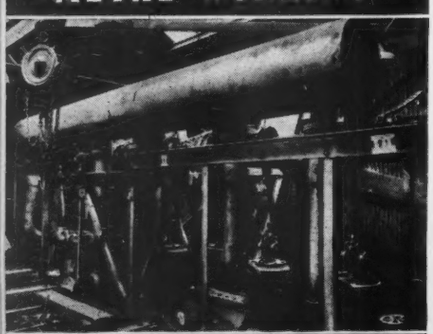
Sales Offices in Principal Cities

Products: Polyphase Induction Motors, Synchronous Motors, Direct-current Motors, Alternating-current Generators, Direct-current Generators, Motor-Generator Sets, Flexible Couplings.



MAINTENANCE

METAL WORKING



MINING

YALE HAND CHAIN HOISTS ARE INDUSTRY'S *first choice!*

There's a reason why industry chooses Yale Hoists—Yale builds hoists better.

Yale pioneered the spur-geared hoist, the hoist that gives the greatest lifting efficiency ever achieved. Yale engineers incorporated into these hoists extra safety features such as: non-fracturing load hooks, detachable shackles, friction-minimizing, rust-resistant steel load chain, self-actuating load brakes, and many more.

And finally, every Yale Hoist is tested up to 150% of its rated capacity, must perform perfectly at this overload, before it leaves the factory.

That industry approves Yale safety construction is borne out by the fact that every year industry buys more Yale Hand Chain Hoists than all other hand hoists.

Are you in the market for a hoist? Follow the lead of the leaders of industry . . . choose Yale Hoists for speed, safety, and economical operation. Get in touch with your local Yale distributor today. Or write to us for catalog.

Capacities 300 lbs. to 40 tons.

THE YALE & TOWNE MFG. CO.

PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.

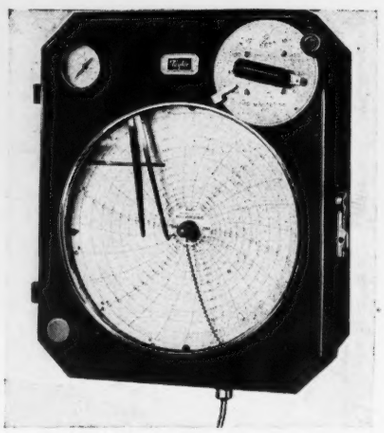
IN CANADA: ST. CATHARINES, ONT.

Makers of Yale Hand Chain Hoists, Electric Hoists, Electric Industrial Trucks, Hand Lift Trucks and Skid Platforms.

25-35 per cent and to make an appreciable saving in the salt required for regeneration.) Regulated back-flow rate is said to prevent channeling and matting and to make the softener self-cleaning. Gravel underbed can be eliminated (when using synthetic zeolite and a lower strainer manifold) so as to provide more space for zeolite. The double-check method may be applied to softeners already installed. Elgin Softener Corp., Elgin, Ill.

Process Timing Mechanism

For Taylor Fulscope recording controllers. This mechanism is said to insure exact duration of batch processing as well as precise temperature or pressure control on applications such as vulcanizers, canners' retorts, hosiery die machines.



Timing process is manually started by adjusting the instrument for desired time period. Timing automatically starts only when the apparatus reaches the set point of the controller regardless of the length of time required for the set point to be reached. The mechanism terminates the process at the end of the desired period. A "stop" furnished on the dial facilitates timing of successive batches of the same duration. Taylor Instrument Companies, Rochester, N. Y.

Small Transformers

Small transformers mounted on bases with prongs for insertion in sockets like those used in connection with socket-type watt-hour meters and detachable induction electrical instruments are easily installed and can be replaced without interference with other circuits. May be used to supply power to low-voltage small-diameter high-efficiency lamps, for close or micro-inspection of small bores or gun barrels. Its multi-tap arrangement permits use in a variety of industrial applications. Sparkes Mfg. Co., 318 Jefferson St., Newark, N. J.

Two-In-One Locker

Designed for use in cramped quarters where saving in floor space is an important consideration, the two-in-one steel locker combines locker space for two persons in the same floor area usually given to one.

Each locker is 15 in. wide, 21 in. deep, 73½ in. high, and is divided into two coat compartments, each of which is 7½ in. wide, 21 in. deep, and 54 in. high. The two hat compartments, placed above the coat compartments, are each 15 in. wide, 21 in. deep, and 9 in. high. Fabricated from heavy-gage furniture steel; all nuts and bolts used in the assembly are cadmium finished to resist corrosion; rubber bumpers are used at contact points to prevent banging doors. Penn Metal Corporation of Penna., 26 Oregon Ave., Philadelphia.

Proportioning Pump

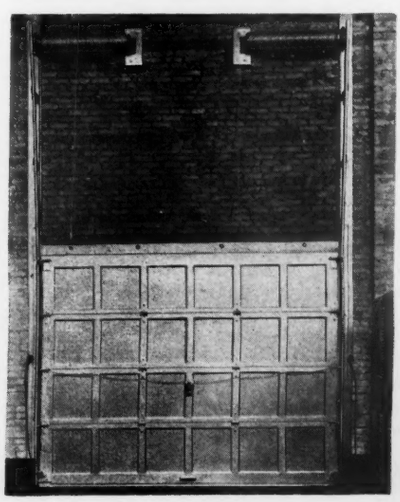
High-pressure, high-capacity, duplex proportioning pump can handle up to 1,200 gal. hr., pumping against pressures up to 20,000 pounds. Can be supplied with pistons and other metal parts coming in contact with solution, of corrosion-resistant stainless steel. Milton Roy Pumps, 3160 Kensington Ave., Philadelphia.

Vacuum Cleaner

A 1-hp., universal-type, aircooled motor powers both models of a new vacuum cleaner. Model 184 has 2-bushel capacity; Model 184-A, 1½ bushels. Features claimed: Both cleaners are streamlined for easy portability and storage; all unnecessary gadgets have been eliminated; both require practically no attention, not even lubrication, it is said; crinkle-finish on containers is durable and long-wearing. A wide selection of cleaning tools is available. Electric Vacuum Cleaner Co., Inc., 1734 Ivanhoe Road, Cleveland.

Overhead Door

Vertical-acting door is spring balanced by means of torsion spring coupled to graduated winding drums. Airplane cables attached to bottom corners of the door wind on the spirally graduated grooves of these drums as the door moves up and down. Graduated grooves are designed so that the lift on the cables remains constant even though the springs unwind as the door opens and wind as the door closes. The door, therefore, is in balance in any position. Cam closing action provides



YALE ELECTRIC TRUCKS

are better!

BETTER—FASTER—MORE ECONOMICAL. Those four words tell the story of Yale Electric Industrial Trucks—and Yale Trucks apply those words to handling operations.

No matter what your handling problem, there's a money-saving Yale Truck for the job. The complete line includes low-lift and high-lift platform, fork, ram and crane models in capacities for every need.

In addition, basic underlying features make Yale Trucks do superior work longer. Here are a few of them:

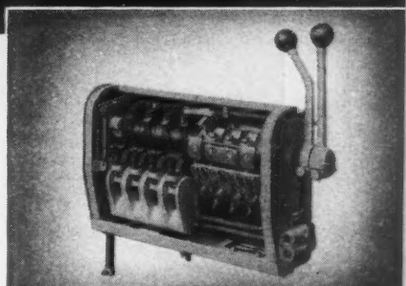
1. Drive Unit . . . uses straight spur, or combination of bevel and spur gears. Gears are drop-forged, chrome-nickel, heat-treated steel, cadmium plated for longer life. For smooth operation, they are mounted on roller bearings and move in an oil bath. Here's *extra* power 24 hours a day!

2. Cam-O-Tactor Controller . . . Positive mechanical cam and roller action makes and breaks contacts, guards against welding of contact points. Permanent alnico blow-out magnets instantly quench arc—lengthen contactor life. This improved simplified controller is safer, trouble-free—means fewer costly repairs and lost hours.

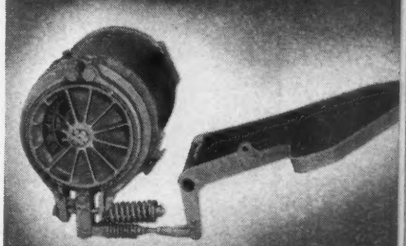
3. Driving Brake . . . mounted directly on motor end head, operates on a high-speed cast-iron drum and transmits the braking action to both driving wheels via a train of gears and differential. Regardless of operating conditions, it brakes the power at the source—gives operator the added safety of simultaneous braking on both drive wheels.

4. Drive Wheels . . . are electrically welded disc steel type, mounted to the driving flange by specially hardened steel dowel bolts. Wheels can be easily demounted without exposing the sealed bearings or disturbing alignment. Servicing time reduced to a minimum!

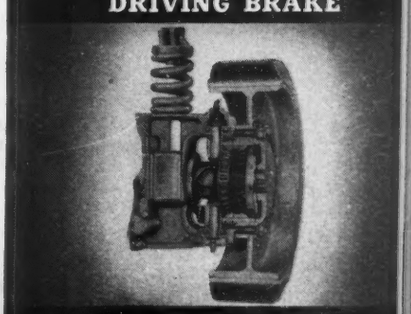
There is a Yale Electric Truck for *your* handling job. The Yale representative (listed in the Classified Directory) will be glad to tell you about it. Or write to us direct.



CAM-O-TACTOR CONTROL



DRIVING BRAKE



DRIVE WHEEL

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

YALE

Makers of Yale Hand Chain Hoists, Electric Hoists, Electric Industrial Trucks, Hand Lift Trucks and Skid Platforms.

Is Maintenance Important?

Some companies consider maintenance a necessary evil, others recognize that a well planned program is the best insurance for continuous production and low cost operation.

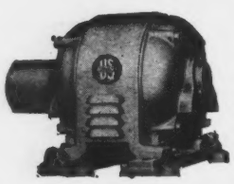
Some of industry's most highly respected maintenance executives have written their views in recent issues of FACTORY.

If you have not already read these articles, we suggest that you review them because they offer many good sound reasons why maintenance is important.

Read FACTORY's "Maintenance Services" Section every month for tested methods gathered from plants all over America.

U. S. LUBRIFLUSH
purges
Motor Bearings
GUN
THE NEW WAY
U. S. Lubriflush method cleanses bearing of old, devitalized lubricant by forcing new lubricant through bearing.
THE OLD WAY
No way is provided for purging the bearing of old, devitalized lubricant. New lubricant merely passes by the bearing.
Patent Pending
Removable plug for draining

Most advanced method of thoroughly cleansing bearings



Here indeed is a revolutionary improvement in the lubrication of motor bearings. U. S. Lubriflush allows new lubricant to be introduced to the innermost recesses of the bearing, forcing the old, wornout lubricant from the bearing and out of the motor through a bottom drain. The bearing is purged of sludgy, devitalized grease, and renewed with clean lubricant. Bearing life is greatly increased. The U. S. Lubriflush system eliminates the necessity of disassembling the bearing to cleanse it. No extra charge is made for Lubriflush if specified on your order.

SEND FOR BULLETIN

An interesting Bulletin describing the new U. S. Lubriflush system in comparison with ordinary motor bearing lubrication will be mailed on request. Mail the coupon.

U·S·MOTORS

REQUEST FOR LUBRIFLUSH BULLETIN

U. S. Electrical Motors, Inc.
74 34th St., Brooklyn, N. Y.
Gentlemen:

☐ Mail U S. Lubriflush Bulletin ☐ Mail U. S. Motors Bulletins

Name_____

Address_____

City_____ State_____

ample running clearance between door and stop strips as soon as door starts to open, yet cams the door to a snug fit against the stops at the end of the closing stroke. Furnished up to 16 ft. wide and 7 ft. high. Can be motor-operated as well as hand-operated. Barber-Colman Co., Rockford, Ill.

Filter Cartridge

Fifth filter cartridge added to those for interchangeable use on the R-1000 respirator is for protection against toxic dusts formed by crushing, grinding, or abrading such solids as lead, cadmium, arsenic, chromium, manganese, selenium, vanadium, and their compounds. American Optical Co., Southbridge, Mass.

Adjustable Voltage Rectifier

Model SP-20 is designed especially to provide d.c. from an a.c. source for testing purposes. Output voltage may be adjusted by means of knobs on front panel in steps of 32, 110, 115, 120, 210, 225, 240 volts. Voltmeter on panel indicates output voltage. Current capacity is 30 amp. at 32 volts d.c. and 20 amp. at all other voltages. Two mercury-vapor tubes are used to obtain full wave rectification of the single-phase a.c. lines. Output voltage is said to remain practically constant from no-load to 25 per cent overload. The rectifier can be supplied with or without a filter choke—desirable where exact duplication of d.c. line conditions is wanted. It contains no moving parts, a hinged cover provides access to tubes and terminal strip, wheels can be installed for portability. Measures 12x12x21 in. without filter, 12x18x21 in. with filter. Mellaphone Corp., Rochester, N. Y.

Heater

De Luxe hiJet Heater has large heat capacity to heat recirculated air for large areas. Air is drawn through recirculating grill, through heating element and filter, and is then discharged into room through the discharge grill. Can be had for use with steam or hot water. Features: Heating element designed with loops to absorb difference in expansion and contraction between individual tubes; entire tube and loop fabricated of red brass with no connecting joints; stay tube that maintains proper relationship between headers without increasing strain on bends of tube and

SKILLED HANDS DESERVE SKILLED TOOLS

• Five popular shapes (actual size) of Nicholson Die-sinker files in Swiss Pattern designs and cuts.

DIE-SINKERS, model makers, delicate-instrument parts finishers can do their best work only when their supplies of small files are *right for the job*—in shapes, sizes, cuts and *quality*.

Therefore, it is only logical that where speed and efficiency are the watchwords, industrial managements should turn to the world's largest file maker when stocking these important tools. For *precision files require the precision manufacture which only long experience and ample facilities can assure.*

Nicholson X. F. Swiss Pattern files are made to highly exacting standards. Points are smaller, tapers are longer and cuts are finer than in the conventional "American Pattern" files for similar purposes. Cleaning out, burring, enlarging small holes, shaping and finishing extra-narrow grooves, slots, notches and keyways are more readily and accurately accomplished.

The automotive, aircraft, die-making and industrial-arts industries use Nicholson X. F. Swiss Pattern files extensively. Assortments are wide, designs are correct, satisfactory performance is assured under Nicholson's guarantee of *Twelve perfect files in every dozen.*

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

• • •

FREE TECHNICAL BULLETIN *and catalog information on X. F. Swiss Pattern, Die-cast, Aluminum, Brass, Foundry, Lathe, Shear-tooth and other Nicholson or Black Diamond special-purpose files.*

NICHOLSON
X. F. SWISS PATTERN FILES
For every exact-filing purpose

World's Largest Shovel Plant

protected by

Carey BUILT-UP ROOFS

THE Ames Baldwin Wyoming Company is another of the many leading industries that depends upon CAREY Roofs for economical, trouble-free service. All buildings of its mammoth plant at Parkersburg, W. Va., have the protection of these famous roofs.

CAREY Roofs wear longer—cost less per year—because they are built up, layer on layer, from high quality felt and asphalt. Over 50 years of roofing experience are back of them—*they must be right.* Whatever your roofing problem, large or small, put it up to CAREY for satisfaction. Write Dept. 31 for "Specifications for Bonded Roofs."

INDUSTRIAL BUILDING PRODUCTS OF
ASPHALT—ASBESTOS—MAGNESIA

Roofing . . . Siding . . . Flooring . . . Insulations . . . Roof Coatings and Cements
Waterproofing Materials . . . Expansion Joint . . . Asbestos Paper and Millboard

THE PHILIP CAREY COMPANY · Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

that allows entrained moisture to drain directly from the supply header to return header without entering other tubes of the heating element; fan and motor assembly constructed for quiet operation. Finish is brown, baked enamel with trim of polished stainless steel. Can be mounted on the floor, placed on walls, or suspended from ceiling; arranged to discharge upward, downward, or horizontally. Furnished in six sizes with capacities from 24,800 B.t.u. and 250 cu.ft. per min., to 145,200 B.t.u. and 1,685 cu.ft. per minute. Speed controller mounted inside the cabinet allows selection of low, medium, or high-speed operation. The Herman Nelson Corp., Moline, Ill.

Aviation Snip

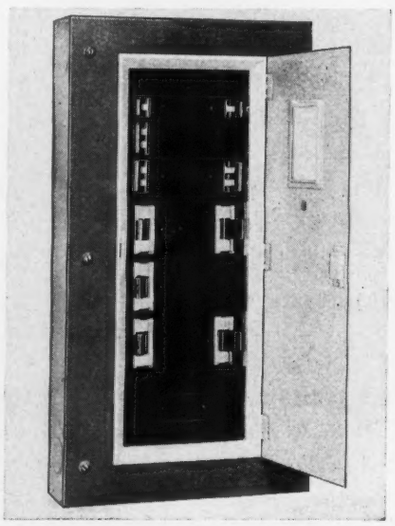
No. 95a compound action aviation snip for metal, cable, and tubing makes cuts on grades of steel up to 16-gage BX cable, BX heavy flexible tubing and wire up to 16 gage. Features claimed: Locking device doesn't interfere with cutting operations; makes ¼-in. short cut and up to 1⅛-in. long cut; not necessary to open snips over ⅜ in. for difficult cuts; beveled blades are made from chrome vanadium alloy molybdenum steel, have serrated cutting edge that does not slip or turn, are removable; handles are cold rolled steel and knurled for grip. Available in right and left hand styles. Penn Tool Co., 2415-25 North Howard St., Philadelphia.

Air Hose

Recommended for use where excessive hot oil conditions are encountered, the air hose features a synthetic tube and rubber cover and is known as Type 54. It is built with a smooth green abrasion-resistant cover. The B. F. Goodrich Co., Akron.

Distribution Panelboard

Type MH Multi-breakeR distribution panelboard has extended the Multi-breakeR principle of construction to include 100-amp., 230-volt, branch circuit capacity for power and lighting distribution. Branch breakers are furnished in 15 to 100-amp.



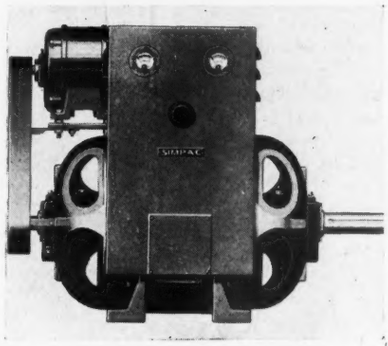
capacities; 1, 2, or 3 poles; for 115 and 230-volt, single-phase and 3-phase a.c. systems. As all breakers used in these panels are common trip, they are suitable for use on ungrounded systems, and single phasing of motors protected by these circuits is prevented. Panels are dead front—no live parts are exposed even when restoring the service after an overload or short circuit. Square D Co., Detroit.

Open-End Wrenches

Line of open-end adjustable wrenches comes in 4, 6, 8, 10 and 12-in. lengths with capacities of $\frac{1}{2}$ to $1\frac{7}{16}$ inches. Jaws are designed to fit square or hexagon nuts and are unusually thin, permitting use of these wrenches in normally inaccessible places. Drop forged of high-grade alloy steel. Both handle and jaw are hardened and tempered. Chrome plated with polished jaws. Bonney Forge & Tool Works, Allentown, Pa.

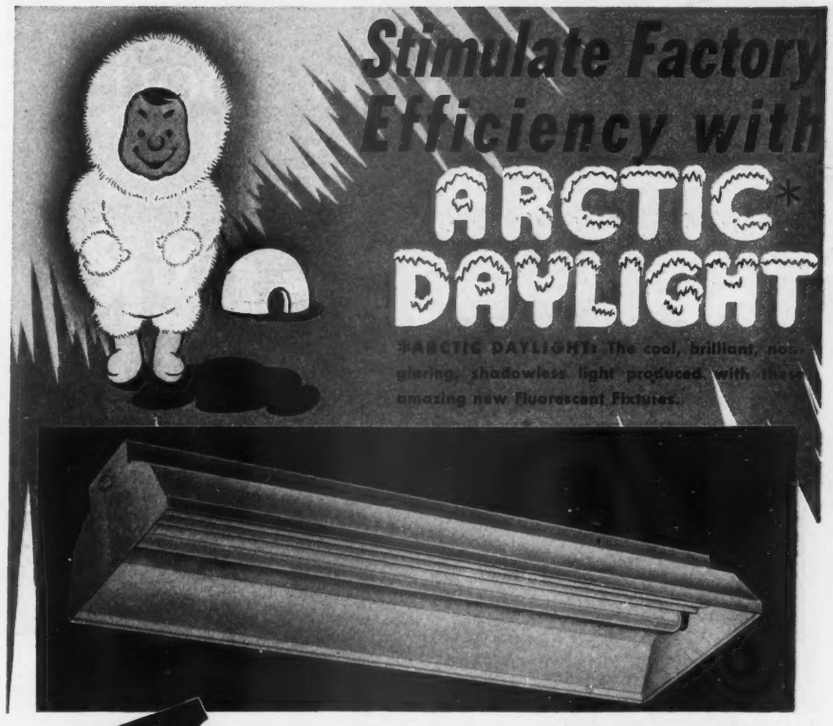
A.C. Power Unit

Simpac power unit is a self-contained a.c. generating unit which regulates, controls, and meters its output. It combines a standard open-type a.c. generator, a d.c. exciter, exciter field rheostat, voltmeter, ammeter, and optional voltage regulator in one integral unit. It may be either engine or electric motor driven, direct or belt connected. Voltage is adjusted manually by exciter field rheostat, the voltmeter being in plain sight of the operator. Generators have an inherent voltage regulation of 10 percent at 80 percent power factor. This variation may be improved to as low as $1\frac{1}{2}$ percent by use of an automatic resistance-type regulator. Ratings from 3.75 to 187 kva. are available, voltages of 120/208, 240, or 480, with operating speeds from 600 to 1,800 r.p.m. Units above 187 and up to 312 kva. may be obtained with separately mounted controls. Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh.



Pump Mount Motor

Line of motors with standard dimensions designed for easy mounting of centrifugal and similar pumps has ratings of from $\frac{1}{2}$ to 40 hp., for operation on 3-phase at 2, 4, and 6-pole speeds. Extended shafts and machined fits for the pump mounting are all standard and the same dimensions throughout the entire range of ratings. A large neoprene washer on the shaft be-


Stimulate Factory Efficiency with
ARCTIC*
DAYLIGHT
*ARCTIC DAYLIGHT: The cool, brilliant, non-glaring, shadowless light produced with these amazing new Fluorescent Fixtures.

Guth FLU-O-FLECTORS
Fluorescent Lighting at Peak Efficiency

GUTH FLU-O-FLECTORS are ruggedly constructed—built to endure heavy industrial uses. Their engineered design insures excellent light distribution, with vertical as well as horizontal illumination. And the ALZAK reflecting surfaces provide the necessary "punch" for maximum effectiveness from Fluorescent Lamps. Speed work and boost efficiency by using these efficient fixtures in YOUR plant.

Light Meter Tests show that the ALZAK reflectors, plus a minimum of "pocketed" light, deliver up to 25% more light output. ALZAK is the most efficient commercial reflecting surface known.

Easy to Clean—
Easy to Maintain

Durable ALZAK is virtually permanent, and its efficiency is unaffected by heat or normal atmospheric conditions. It may be cleaned by washing with soap and water. In the GUTH FLU-O-FLECTOR, the ALZAK reflector is easily removed from the fixture so that, with extra reflectors on hand, the maintenance crews simply take down the dirty reflectors to be washed—substituting reflectors which have been cleaned on the floor or at the bench. That's safety, plus time saving, plus as much as 25% better cleaning!

→ *Write Today for Full Particulars*

The EDWIN F. GUTH COMPANY
2615 Washington Blvd. St. Louis, Mo.
Leaders in Lighting Since 1902

Guth

What to do about the SNOOPER!

SNOOP (*snoop*), *v.i.* [*D. snöepen*]
To look or pry about in a sneaking or meddlesome manner; also to search pryingly for information, etc.—**SNOOPER** (*er*), *n.* one who snoops.
—*Webster's Dictionary*

NOW is the time to keep prying eyes away from your plant—to be sure that burglars, trespassers or others who have no business on the premises are kept out . . . to prevent the work of firebugs. It's too big a job for your watchman to do alone. But you can have a record of every man who enters your plant—and every piece of material that goes out when the watchman has the help of U·S·S Cyclone Fence.

Cyclone Fence provides easy entrance for people you want, at conveniently located gates. And it politely, but forcefully refuses admittance to people you don't want in your plant.

Get the facts now about protection of sturdy, long-lasting Cyclone Fence. We'll gladly make a recommendation and give a free estimate with no obligation to you. Remember, Cyclone leads the field in sales, so our prices must be right.

CYCLONE FENCE CO., DEPT. 9100
Waukegan, Ill.
Please mail me, without obligation, copy of "Your Fence—How to Choose It—How to Use It." I am interested in fencing: ☐ Industrial; ☐ Playground; ☐ Residence; ☐ Estate; ☐ School. Approximately.....feet.

Name.....
Address.....
City.....
State.....

FREE! *32-Page Book on Fence*

Send for our free 32-page book that tells all about fence. Crammed full of illustrations. Shows 14 types—for home, school, playground, and business. Whether you need a few feet of fence or 10 miles of it, you need this book.

USS **CYCLONE FENCE**

CYCLONE FENCE COMPANY, Waukegan, Ill.
Branches in Principal Cities
Standard Fence Company, Oakland, Calif., *Pacific Coast Division*
United States Steel Export Company, New York

UNITED STATES STEEL

tween the pump packing and motor bearing, in combination with a trough cast around the bearing, makes it impossible for any of the material pumped by the unit to find its way into the motor bearing in the event of packing looseness or wear or material dripping down the side of the motor bracket. The projecting shaft is covered with a special hard stainless steel tube. Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles.

Lift Jacks

Lift jack for use with platforms features easy coupling and uncoupling. Handle rests on wheel axle so that when handle is moved downward the platform is lifted and the jack can move into position. In uncoupling, handle is raised and

moved to either side to engage notch in housing; engaged handle is raised to lower platform and release the jack. A "de luxe" model has a locking mechanism so that when pedal is operated jack locks fast to platform and cannot disengage, in spite of bumps and jars. Standard model comes in wheel diameters of 5, 6, and 8 in., for platforms from 24x36 to 30x48 in.; de luxe model comes in 6 and 8-in. sizes for platforms of same sizes. Bond Foundry & Machine Co., Manheim, Pa.

Pliers

No. 402 is a 6-in. plier with tapering jaws measuring 1½ in. to facilitate use in small spaces. It is said to have ⅝-in. jaw opening. Jaws are made of nickel alloy steel and are heat treated. It also has parallel jaw action—jaws open like a vise, open throat through which wire may be fed, compound leverage, outside cutting jaws that snip off nails. The Wm. Schollhorn Co., New Haven, Conn.

Jacket-Water Cooler

Diesel engine jacket-water cooler uses principle of heat dissipation by evaporation of water. It consists essentially of a coil through which the jacket water is passed, nozzles to spray water on the coil, and a blower to force air past the coils. In operation, the hot jacket water enters the cooling coil at top of the cooler, water from another source is sprayed over the coil from one end, and air is blown in from the other end. As water outside the

When Simon Degree is *IN* . . . You're *OUT*

STOP HIM WITH MODINES

Be on the alert for this skulking saboteur — Simon Degree! His objective is your factory, laboratory or office. Once *he's in*—you're *money out!* He sows the seeds of production paralysis. He personifies inadequate, ineffective heating—with its harvest of losses.

Right now, faster and greater industrial production is Uncle Sam's first line of defense . . .

Meet and beat Simon Degree's secret sabotage with Modines—the most modern and most effective method of heating.

Modines Protect Your Profits

If you are modernizing or expanding your present plant—or constructing an entirely new one—protect your production and profits with the *proved performance* of the Modine Unit Heater.

Modern, automatic, fast... Modine Unit Heaters maintain even temperatures that insure continuous plant operation, improve workers' comfort and efficiency, cut costs of fuel and maintenance.

Every Modern Feature

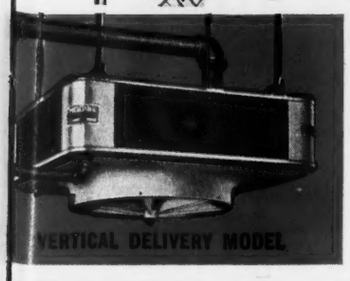
Built by pioneer heat-transfer specialists, Modines have *every* desirable feature of *any* unit heater. Only Modine has all these features: Built-In Safety Fan Guard, *Bonderite* Rust Protection, Sound-Silenced Operation, Velocity Generators.

No Delays With Modines

And *Modine-patented* direct-from-branch-supply-pipe suspension makes installation easier, less costly, *and speedier!* Your plant expansion program goes forward without delays. Prompt delivery is a part of Modine preparedness. Ask your engineers . . . *get Modine literature now.*

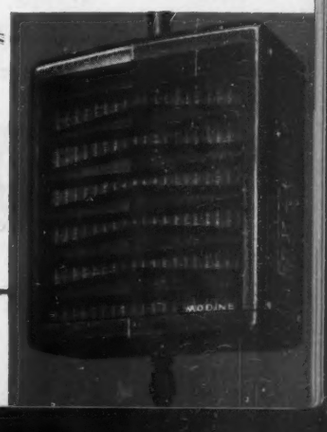
MORE MODINES ARE SOLD THAN ANY OTHER UNIT HEATER

Modine representative's name is in your phone book "Where to Buy It" section under Heating Apparatus.



modine

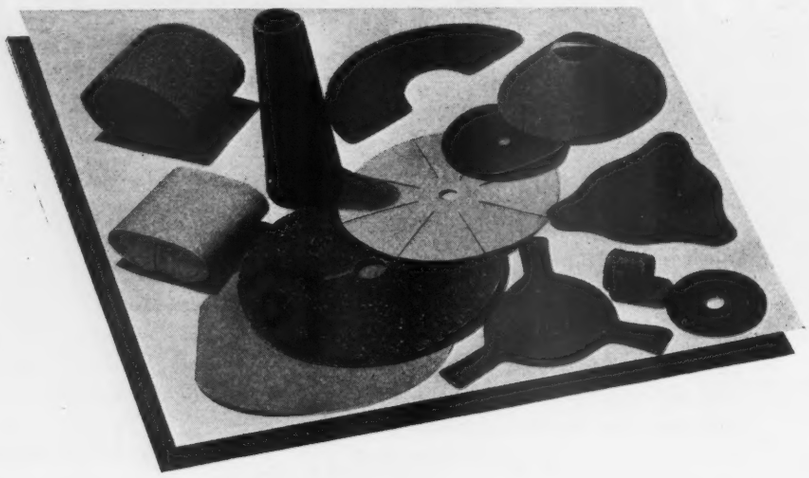
THE UNIT HEATER PROTECTED AGAINST RUST BY BONDERIZING



MODINE MANUFACTURING COMPANY, 1730 RACINE STREET, RACINE, WISCONSIN

COATED ABRASIVES

In Special Shapes and Sizes



...48 HOUR ACTION!

Don't think you have to wait . . . and wait . . . because your finishing operations require a special size or shape or grit. AP is geared up to give you 48-hour action no matter how complicated your needs may be. The minute your rush order arrives at our factory, the AP special production schedule starts moving swiftly. In less than 48 hours your shipment is on its way!

Typical of AP service that includes an Engineering Staff to give your problems individual attention without obligation – a special container, "Masterpak," to protect your sandpaper shipments from rough handling and bad weather – and products so good they're guaranteed to boost your production, or no bill sent. Specify AP on your next abrasive order, and learn what Service really is!

FREE TRIAL

Order a ream or a 50 yard roll of the coated abrasive that meets your needs. Use up to half. If it doesn't boost your production, return the balance and no bill will be sent. Abrasive Products, Inc., 519 Pearl Street, South Braintree, Massachusetts.

ABRASIVE PRODUCTS
SOUTH BRAINTREE MASSACHUSETTS
JEWELOX • JEWEL EMERY • JEWEL GARNET INC. JEWELITE • JEWEL FLINT • NEW PROCESS

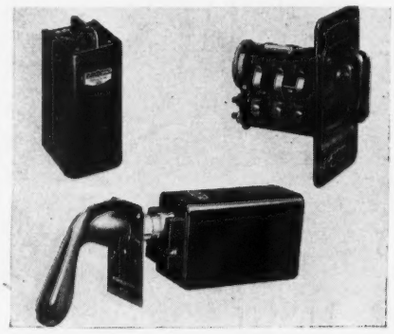
coil evaporates, it cools the coil and the jacket water which is then returned to the engine. Cooling coil is fabricated of ⅜-in. outside diameter hard drawn copper tube hot tinned dipped. Bronze spray nozzles are of the cleanable, swivel type. Frame assemblies are of angle iron, electrically welded and hot dipped galvanized. Enclosing panels are of 16-gage galvanized steel. Designed primarily for indoor operation, although units for outdoor installation may be secured. Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago.

Air Compressor

Model 60 Fordair air compressor, with stationary mounting, is intended for isolated spots where compressed air is needed, and yet where electrical charges are prohibitive. Engine and compressor are built into one V-block. Has built-in cooling system, electric starting system; can be adapted to operate on natural gas instead of gasoline. Capacity: 60 cu.ft. per min. at 100 lb. actual air delivered. Available with fuel and air tanks mounted, or without these accessories. Schramm, Inc., West Chester, Pa.

Drum-Type Master Switch

Providing 3-wire control for machine tools and other equipment, this switch is said to afford functions equivalent to two and three-button heavy-duty pushbutton stations and is offered for use where an



operating lever is desired. Three constructions—surface, cavity, and panel mounting; two kinds of handles—standard and pistol grip. Removing a "stop" post permits the drum to be converted from non-reversing to reversing. Nameplate is marked on one side for reversing and on the other for non-reversing service. For pilot circuits up to 600 volts a.c. and d.c. Cutler-Hammer, Inc., 315 North 12th St., Milwaukee.

Fire-Fighting Trailer

For the protection of large but separated flammable liquid or electrical hazards, a large capacity, carbon-dioxide fire extinguishing unit has been designed that can be attached to any truck or tractor and quickly towed to scene of the fire. The wheeled unit carries as many as ten 50-lb. cylinders of carbon dioxide gas and one or two hose reels with 100, 150, and 200 feet of high-pressure hose, and discharge horns fitted with quick-opening valve for controlling gas discharge. Pressure-oper-

ated valves, operated by pressure of discharge gas from initially released control cylinders, discharge portion or all of cylinders simultaneously; this eliminates levers and weights for each individual cylinder and minimizes possibility of accidental discharge. Standard-size balloon tires are regular equipment. The unit is mounted so that it will not tip over backward and when not attached to a mobile unit it rests upon two short steel supports which fold under front of trailer frame when not in use. C-O-Two Fire Equipment Co., 10 Empire St., Newark, N. J.

Light-Weight Compressor

Two-stage air-cooled compressor, the D-60, delivers 60 cu.ft. of free air per minute at a discharge pressure of 100 lb. and is said to be capable of operating most of the grinders, paint sprays, and other pneumatic tools in common use. It is portable and comes with three mountings built around the same gasoline engine-compressor plant. The Push-about is mounted on roller-bearing pneumatic-tired wheels, can be rolled on and off a truck, can be handled by one man on the ground. The Deluxe Model (with electric starting) is a spring-mounted high-speed trailer unit with tool boxes for carrying equipment built into the sides of the body. The Utility Model (with electric starting) is mounted on a steel base and can be mounted directly on a service truck or built into the body. Ingersoll-Rand Co., 11 Broadway, New York.

Aluminum Stepladders

Two A-type aluminum ladders are constructed with steps on both sides instead of on one side as in the conventional step-ladder, for use where two persons must use ladder at the same time, and where ladders must be used in narrow aisles. Both ladders are constructed of a strong aluminum alloy which is light in weight. No. 900 is 36 in. high, has a platform 12x15 in., weighs 13 pounds. The feet are fitted with rubber pads. No. 901 has

1/2 A MAN SAVED

by Doc. Steelstrap

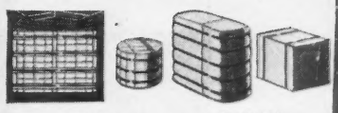
Freeing one man of a crew of three for half-time duty in another department was only one advantage obtained by a midwestern manufacturer in applying the Acme Steelstrap Process. Waste motion and unnecessary materials were eliminated. Additional floor space was made available and shipping costs were reduced.

The use of cut length strap, which one man tensioned and a second man sealed, was the method formerly employed. Now Acme Nos. 1 and 2 Steelstrappers are used—tensioning and automatically sealing the strap in one operation. The Coil Trays (containing Acme Steelstrap) and the Steelstrappers are mounted overhead—saving floor space and time and making the entire packing operation more flexible.

There is an Acme Process to meet *every* packing and shipping requirement. Manufacturers in every industry are using one or more of the 429 Acme tools and accessories to obtain the advantages of lower freight and material costs, fewer damage claims and elimination of pilferage losses. Why not let an Acme engineer cooperate in determining the tools and arrangement which will assure *you* maximum speed and economy? No obligation; just use coupon. Acme Steel Company, 2831 Archer Ave., Chicago, Ill.

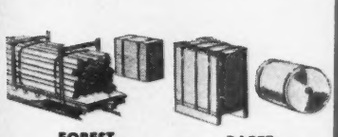
Branches and Sales Offices in Principal Cities

The Acme Steelstrap Process is applied in EVERY AMERICAN INDUSTRY to simplify, protect and economize the handling, packing and shipping of ALL TYPES OF PRODUCTS



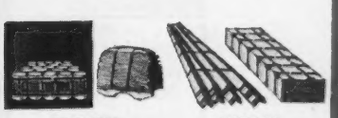
FOOD
Bracing pool cars and cheese drums

TEXTILES
Reinforcing bales and cartons



FOREST
"Packaging" car of poles and bundles of shook

PAPER
Protecting paper on skids and in rolls



PROCESS
Unit-loading drums and skid-loading hides

METALS
Bundling sheets and structural shapes

ACME *Steelstrap* PROCESS

FOR MAKING SHIPMENTS "BOUND TO GET THERE"

ACME STEEL COMPANY
2831 Archer Avenue, Chicago, Ill.

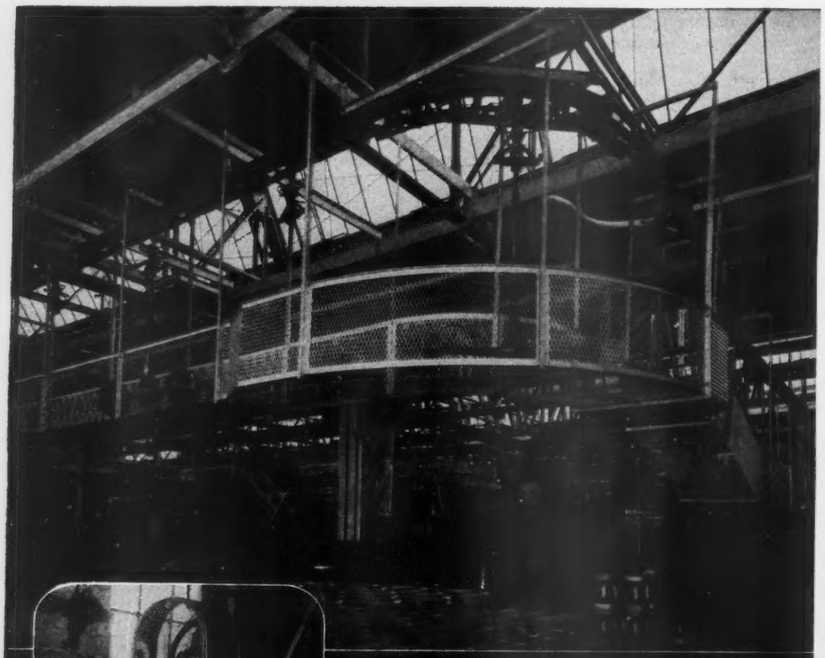
( ) Have an Acme engineer call.

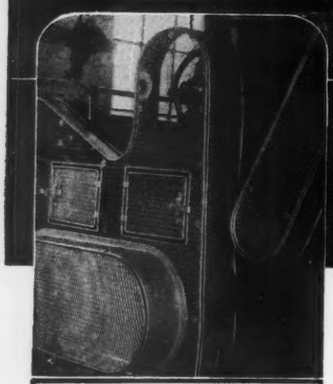
( ) Mail a free copy of "Stopping Profit Leaks" which illustrates the application of the Acme Process in every industry.

Name.....

Address.....

City.....*State*.....

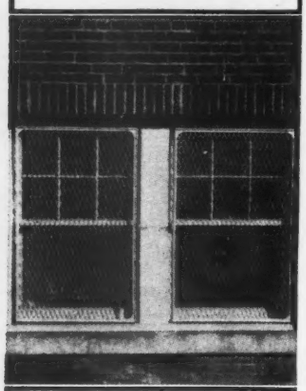




Steelcrete Expanded Metal Machinery Guards of strong, diamond mesh protect and keep all moving parts, belts and gears always in view.

Safely Enclosed YET ALWAYS VISIBLE

STEELCRETE Expanded Metal Conveyor Guards protect your equipment from damage and your employees from accidents. The open diamond mesh keeps everything visible. Any article dropped from the production line can be located and quickly replaced. Steelcrete Expanded Metal Conveyor Guards may be purchased ready for installation or they can be fabricated in your own plant . . . easy and economical to install. Write today for new pamphlet.



Steelcrete Expanded Metal is available in gauges and sizes suitable for Window Guards and can be furnished with frames.

"IT'S WHEELING STEEL"

LISTEN TO THE MILL WHISTLE!
Every Sunday 5 P. M., E.S.T.
THE MUSICAL STEELMAKERS
Coast to Coast Mutual Broadcasting System

Steelcrete

Expanded Metal

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses:
New York • Chicago • Detroit • Cleveland • Pittsburgh • Philadelphia • Boston • Buffalo • Houston • Atlanta
Export Office: 330 West 42nd St., New York, N. Y.

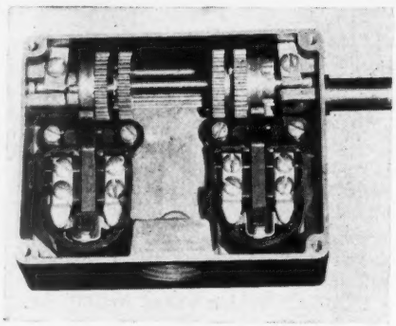
a platform constructed of treadplate for protection against slipping; this platfrom is 19½ in. wide by 22 in. long, and is 4 ft. above the floor. Siderails rise 21 in. above the platform. This ladder is 25 in. wide by 41 in. long at the base, and weighs 40 pounds. Can be supplied with rubber or any other type casters. Aluminum Ladder Co., Tarentum, Pa.

Die Lifter

The Shop-Lifter is a portable, manually operated elevator for moving heavy dies in and out of presses and storage racks. It can also be used for lifting heavy metal parts, for stacking boxes, skids, and drums. An automatic unit clutch will hold platform at any height until cranked down. Rated capacity is 500 lb.; overall height, 72 in.; platform lift, 57 in. above floor level. Platform dimensions: 24x24 in.; base frame is 24 in. wide by 33 in. long. Two swivel casters and two stationary wheels with pushbar are furnished, or as an alternate, steering lever handle with automatic floor lock feature. Economy Engineering Co., 2653 West Van Buren St., Chicago.

Limit Switch

Small-size, geared-type limit switch designed for application on motor-driven devices where it is necessary to limit rotation of motor shaft or some rotating shaft or gear on the driven machine. Features: Double-break, silver contacts which clean



themselves with a rocking motion; mechanism easily adjusted to operate contacts between a minimum of ½ turn of driving shaft to a maximum of 120 turns (an overtravel of 3½ turns is provided to prevent accidental damage to switch mechanism), and three holes in the base by which the switch may be mounted in any position. Contracts are designed for 125-volt, 4-amp., a.c. operation, and 1,250-volt, 1-amp., d.c. operation. General Electric Co., Schenectady, N. Y.

Watchman's Tour System

A new watchman's tour system adaptable to every size and kind of industry provides complete mechanical control over the watchman's activities and protects him in case of mishap. It compels the inspection of specific parts of a property at prescribed time intervals; it can flash or permanently record the time of inspection. Comprises system of key stations with transmitting stations at start and finish of

"It's done a great job for us"

. . . say Operating Officials

"GULF PERIODIC CONSULTATION SERVICE has helped us improve production and reduce maintenance costs"

"This practical cost-reducing tool has done a great job for us," say operating officials in many industries. "With GULF PERIODIC CONSULTATION SERVICE our machinery is producing at a higher level of efficiency and — better still — our maintenance costs are lower!"

Are you seeking a means to step up production and reduce operating costs? Here is a definite step you can take — at once! Call in a Gulf engineer and ask him to make a study of your mechanical equipment, then give you his recommendations for improved lubrication practice which will increase the efficiency of your machinery.

Without one cent of additional investment, you can have the benefits which GULF PERIODIC CONSULTATION SERVICE has brought to scores of plants in all industries. This cooperative service brings you the continuing interest of a thoroughly trained lubrication engineer who has had broad experience with machinery similar to yours. His study of the conditions under which your equipment operates will reveal opportunities for better lubrication practice which will improve both quality and quantity of production. This means *real dollar savings* to you!

The Gulf line of more than 400 quality oils and greases is quickly available to you. They are distributed through 1100 Gulf warehouses in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF PERIODIC CONSULTATION SERVICE is *the modern approach* to your lubrication problem. Protect your equipment against the hazards of mechanical difficulties and their attendant expense. Write today for your copy of the booklet.

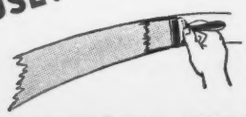
Write for FREE copy of this booklet

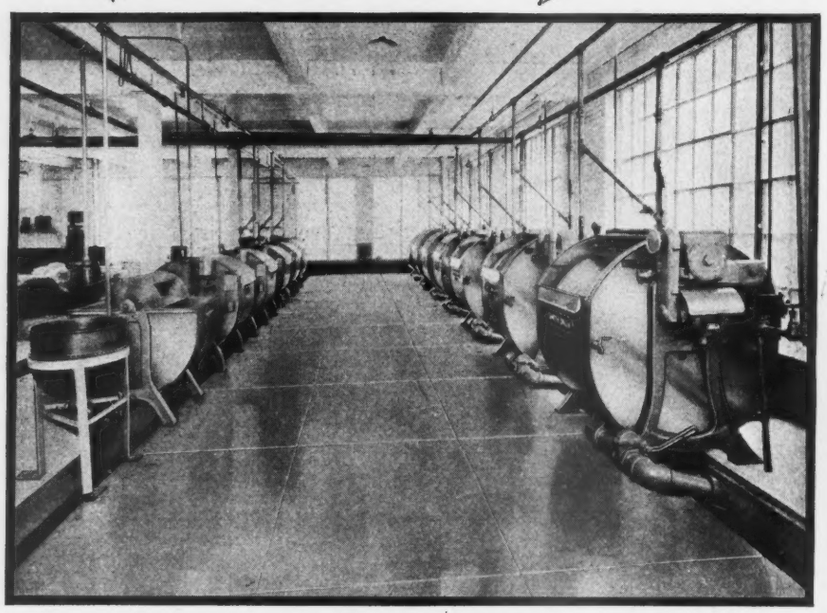
GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation — Gulf Refining Company F.M.&M.
Room 3813, Gulf Building, Pittsburgh, Pa.
Please send my copy — no charge — of the booklet "GULF PERIODIC CONSULTATION SERVICE."
Name.....
Company.....
Address.....

STOP!

WE WOULDN'T RECOMMEND No. 5000 FOR INDOOR USE!





Permite Ready-Mixed Aluminum Paint No. 1000 Is Recommended for Walls, Ceilings and Fixtures!

PLEASE DON'T MISUNDERSTAND US!

We have every reason to believe that No. 5000 —"Outdoor Permite"—is the *best* ready-mixed *aluminum paint* that can be used on outdoor *exposed surfaces.* It resists sun, rain and even smoke, steam and fumes. Heat and cold do not affect it.

But, for *interior* surfaces of all types where *appearance* and *illumination* are *prime requisites,* Permite *Ready-Mixed* Aluminum Paint No. 1000 is particularly suited. The brilliant Permite finish reflects 60% to 75% of the light falling on it; is lasting; is easily kept clean.

There are 14 *specialized* ready-mixed aluminum paints — each *best* for a specific purpose. For data showing which of the 14 are best for *your* plant, send for new booklet on why, how and where to use aluminum paints.

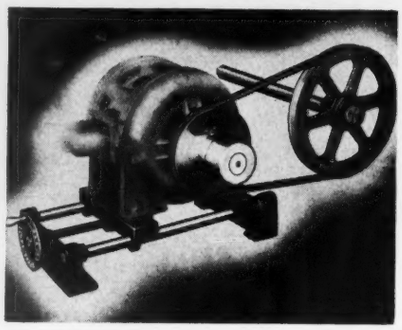
ALUMINUM INDUSTRIES, Inc.
Cincinnati, Ohio
Distributors in Principal Cities

PERMITE *Ready-Mixed*
ALUMINUM PAINTS

each series. Transmitting stations can actuate any kind of signal or recording apparatus. Recording clock shows date and exact time each transmitting station is visited. Delayed alarms give warning at any specified location when a transmitter box is not visited within a given time period. The watchman's tour key is small enough to be carried inconspicuously in the pocket. It is a combination of three separate locks operating only on a predetermined route and only in proper sequence. It has a built-in cyclometer which counts the stations visited. Dudley Lock Corp., 325 North Wells St., Chicago.

Variable-Speed Drive

By means of the Vari-Speed Jr. any standard constant-speed motor of fractional to 1½ hp. is easily converted into a variable-speed unit. No special shaft extension is required. The Vari-Speed Jr. comprises a disk assembly and adjustable motor base. The disk assembly consists



of two cone-shaped disks (one stationary and one laterally adjustable), a self-adjusting tension spring, a spring-adjusting nut and cover. This assembly is applied directly to the standard shaft extension of the motor and the motor is mounted on an adjustable base. A V-belt drives between the two disks and the sheave pulley on the driven shaft. By means of an adjustable handwheel the motor is moved backward and forward. Built in six sizes of disk assembly, providing speed control over a range of 1¾ to 1 to 2¾ to 1. Two sizes of motor bases are available. Reeves Pulley Co., Columbus, Ind.

Non-Magnetic Steel

Non-magnetic, free machining alloy steel has been developed especially for the electrical industry. Has magnetic permeability of only 1.003 to 1.006 at 1000 oersteds magnetizing force at temperatures from sub-zero to boiling, it is said. High electrical resistance, which reduces eddy current loss, is a feature. Can be readily formed, welded, machined, or blanked. Can be used in transformer, controller, and switch covers; entrance plates; spacing bars; end fingers. Jessop Steel Co., 527 Green St., Washington, Pa.

Automatic Vise

Movable jaw of automatic vise slides free and is easily pushed with the hand or body against work to be clamped. This, as well as the clamping and releasing, is

No Cutting of Conductors
No Interruption of Service

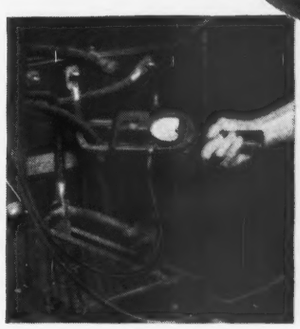
The
NEW
G-E Hook-on Volt-ammeter
Measures Current Instantly

TYPE AK-1, FOR ALTERNATING CURRENT

JUST hook the instrument around the line and read "amperes." Or, connect leads to the convenient binding posts and read "volts." There's no need for additional equipment of any kind—no necessity for cutting conductors or shutting down equipment.

You can measure alternating current in insulated or non-insulated conductors up to two inches in diameter. Four current ranges, 0–15/60/150/600 amperes, are available at the setting of a plainly marked range-selector switch.

This low-priced instrument is small enough to get into tight places, light enough to be carried on a lineman's belt, and accurate enough for a great variety of measuring jobs.

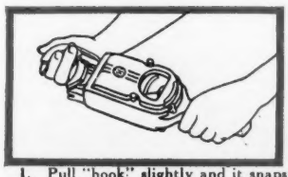


A Single Set-up for Current and Voltage

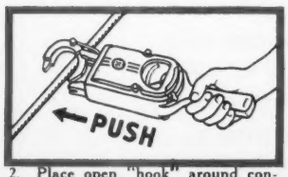
Two voltage ranges, 0–150/600 volts, are also provided. Just set the switch to the desired voltage range, then connect leads to the terminals on the front of the instrument. (Voltage leads are furnished with each instrument.)

Leaving the voltage leads connected does not affect current readings. Just read the "amps," then flick the switch and read "volts."

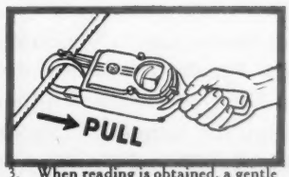
PUSH-PULL OPERATION GIVES TRIGGERLESS SAFETY



1. Pull "hook" slightly and it snaps open. No trigger to pinch fingers.



2. Place open "hook" around conductor; a slight push on handle snaps it shut, and instrument is ready for reading.



3. When reading is obtained, a gentle pull on handle opens dovetail joint and releases conductor. No trigger connected to live parts.

Send for This Free Bulletin Today

Our bulletin GEA-2950 gives complete information about this time-saving instrument. Call your G-E Office or write General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

602-11

• *View of the Sly Dust Filters with pipes drawing the dusty air from tobacco cleaning and stemming operations. The collected dust is discharged through hoppers extending down to the floor below.*

HOW SLY *DUST* FILTERS HELP INDUSTRY AND CONSUMER

AT the plant of a prominent manufacturer of cigarettes and tobacco these two Sly Dust Filters serve a threefold purpose:

1. Help clean the tobacco
2. Maintain a clean and healthful atmosphere
3. Cut manufacturing cost by saving the conditioned air

These filters remove all the dust from the air (it is taken from the air conditioned building, filtered and returned to the building at the rate of 36,000 cu. ft. of air per minute).

Connected to different kinds of machines, used in the preparation of tobacco, the filters contain over 14,000 sq. ft. of special filter cloth.

This installation is but one of thousands throughout industry. Sly Dust Filters collect over a hundred different dusts in 56 industries. As specialists in dust control and pioneers and leaders in the field, we offer you the benefit of this experience in solving *your* dust problems. You'll find startling economies in Sly Dust Filters—notable savings in cost, space and power. Ask for new Bulletin 98.

THE W. W. SLY MANUFACTURING CO.

Branch Offices in Principal Cities

4755 Train Avenue Cleveland, Ohio

an instantaneous operation, both of the latter being accomplished through foot pedals. The main clamping pedal gives sufficient pressure for general work, but if additional pressure is desired, small auxiliary pedal immediately below main pedal will give enough to hold practically any work. The two side pedals are for releasing. Small screw adjustment sets tool for repetitive work so that it operates automatically. Can be mounted on workbench or installed on portable stand. Vital parts of the tool are made of steel and all working parts are casehardened. The Automatic Vise Sales Co., 2845 Sunset Place, Los Angeles.

Miniature Solder Pot

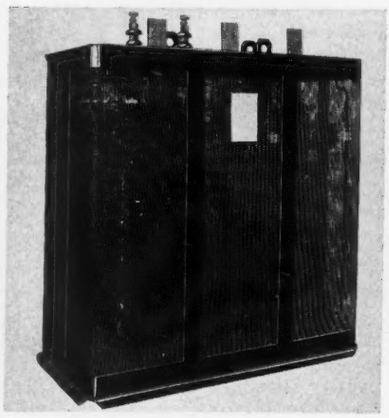
Cast-iron solder melting pot of $\frac{3}{4}$-in. inside diameter and $\frac{3}{4}$-in. depth is made to hold $1\frac{3}{4}$ oz. of 50/50 solder. It is insulated against loss of heat and has adjustable thermostatic heat control. It can be supplied for use on a.c. or d.c. current. Case is chromium-plated and the base finished in polished black gunmetal. Fiber feet are provided. Current consumption is 75 watts. Vulcan Electric Co., 600 Broad St., Lynn, Mass.

Gearshift Motor

Gearshift which gives three speeds forward and one reverse, or four speeds forward and four reverse (with aid of a reversing switch) is built as an integral part of electric motor and also as a gearshift drive which can be used with any standard motor. A lathe bracket for use with the separate drive unit is also made. The gearshift is intended for application on machine tools and other machines where there is need for speed changes. Lima Electric Motor Co., 440 North Main St., Lima, Ohio.

Aircooled Transformers

Design permits higher operating safety and elimination of fire and explosion hazards, it is said. The transformer housings are constructed of expanded metal finished in baked-on moisture-proof enamel which permits flow of air from all sides and provides safety against accidental contact with live terminals. Further features claimed: Primary and secondary coils are separated by air spaces, the windings are designed



WRIGHT
Improved High Speed HOISTS

...DEPENDABLE IS RIGHT!

There are 21 definite points of superiority that make the Wright the dependable hoist it is. Users soon discover these points and value them.

Every Wright Improved High Speed Hoist is fast, smooth and positive in action—because of Wright precision load wheel bearings. It is immune to corrosion—because of its full zinc coating. Its load chain always stays in the pocket, regardless of operating position—because of the Wright safety guard. These are only three of the 21 points. The others are equally important.

Wright Trolleys are as dependable as Wright Hoists—made to give long, faultless service.

Write for the Wright Catalog describing modern hoisting equipment in capacities from ¼ to 50 tons.

BUY ACCO QUALITY *in Wright Hoists, Cranes and Trolleys; Tru-Lay Preformed Wire Rope; Reading-Pratt & Cady Valves; Campbell Abrasive Cutting Machines; American Chains; Page Welding Electrodes and Page Wire Fence.*

WRIGHT MANUFACTURING DIVISION • YORK, PENNSYLVANIA

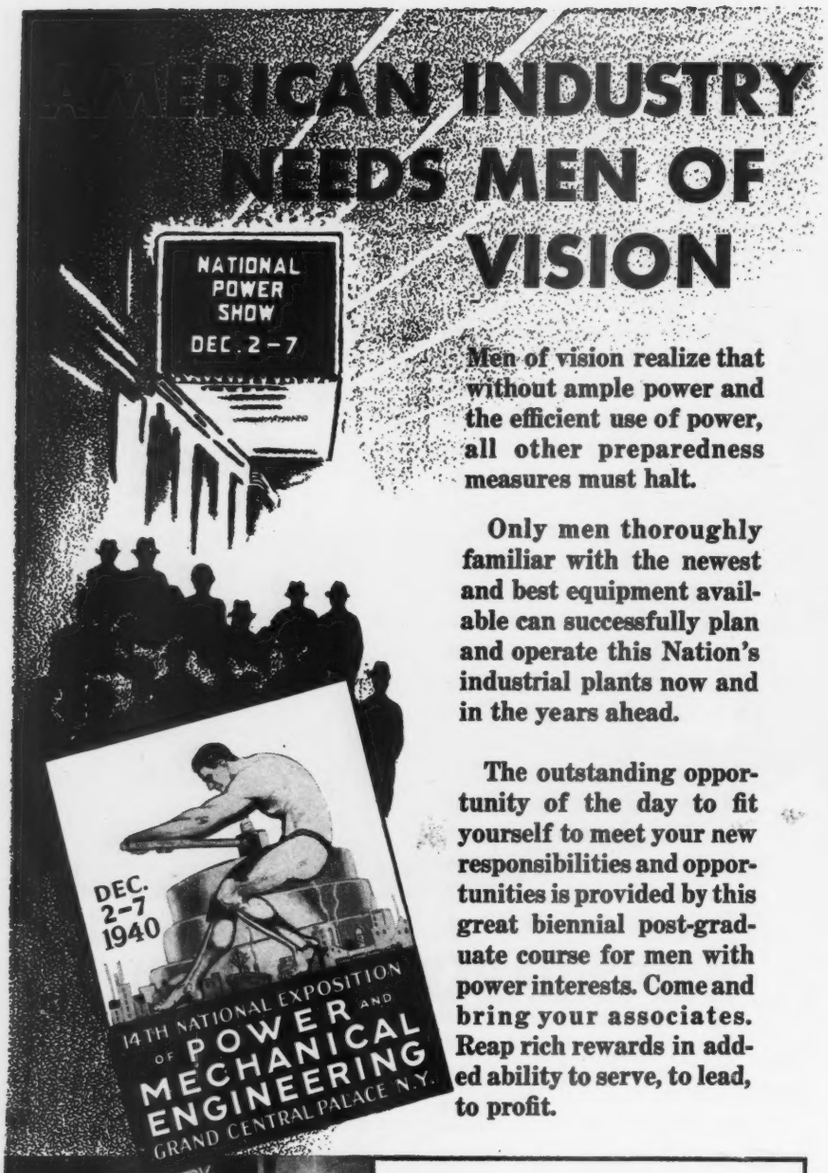
AMERICAN CHAIN & CABLE COMPANY, Inc.

AMERICAN CHAIN DIVISION
AMERICAN CABLE DIVISION
ANDREW C. CAMPBELL DIVISION
FORD CHAIN BLOCK DIVISION

HAZARD WIRE ROPE DIVISION
MANLEY MANUFACTURING DIVISION
OWEN SILENT SPRING COMPANY, INC.
PAGE STEEL AND WIRE DIVISION

READING-PRATT & CADY DIVISION
READING STEEL CASTING DIVISION
WRIGHT MANUFACTURING DIVISION

In Canada:
DOMINION CHAIN COMPANY, LTD.
In England:
BRITISH WIRE PRODUCTS, LTD.
THE PARSONS CHAIN COMPANY, LTD.


AMERICAN INDUSTRY NEEDS MEN OF VISION
NATIONAL POWER SHOW DEC. 2-7
DEC. 2-7 1940
14TH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING
GRAND CENTRAL PALACE N.Y.

Men of vision realize that without ample power and the efficient use of power, all other preparedness measures must halt.

Only men thoroughly familiar with the newest and best equipment available can successfully plan and operate this Nation's industrial plants now and in the years ahead.

The outstanding opportunity of the day to fit yourself to meet your new responsibilities and opportunities is provided by this great biennial post-graduate course for men with power interests. Come and bring your associates. Reap rich rewards in added ability to serve, to lead, to profit.

LOOK, LISTEN, COMPARE, APPLY

More than 300 exhibitors . . .

•

Hundreds of live displays—3 floors—at the Power Capital of the World

•

Power generation, transmission, and application

•

Methods, machinery, equipment, materials, instruments, tools, supplies, services

•

Hundreds of experienced engineers in attendance at exhibits to discuss your problems, answer your questions, demonstrate displays

•

A preview of Power progress

•

Admission is by registration.
You are cordially invited to attend

14th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING

GRAND CENTRAL PALACE NEW YORK DEC. 2-7, 1940

Management, International Exposition Co.

for a 75-deg.-C. temperature rise under continuous full-load operation, heat-resisting insulation is used throughout, need for protective vaults is eliminated, location near load center is possible thus permitting short secondary cable runs. Ratings: 60 cycles ranging from 150-500 kva. inclusive for single phase and 150-1,000 kva. inclusive for 3 phase, voltages 13,200 volts and below. Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh.

Vertical Unit Heaters

Vertiflow unit heaters are designed particularly for high ceiling installations. The line includes twelve sizes varying in capacities from 63,000 to 480,000 B.t.u. per hour. These units may be installed high above the floor close to the ceiling to eliminate any possibility of air stratification. Young Radiator Co., Racine, Wis.

Flashlight Storage Battery

Rechargeable flashlight battery for popular two-cell 1¼-in. size D flashlight cases can be charged when it grows weak, just as can any storage battery. The arrangement of the chamber and vent plus semi-fixation of the electrolyte make it spill-proof. Plates are over ¼ in. thick and are connected to terminals by reinforced electrodes, so that the battery is rugged. Case is of transparent Lucite. A small charger is available which plugs into any 110-volt 60-cycle socket. Also available is a clip for charging from a 6-volt automobile battery. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Welding Positioner

Model 12 Positioner, capacity of 1,200 lb., can be tilted a total of 135 deg. from horizontal and table can be revolved through a full circle (360 deg.) regardless of angle of tilt, it is said. Table is removable for attachment of special jigs or fixtures and is adjustable in height. By mounting the operating mechanism on a special base, the Positioner can handle large and bulky work and rotate it when tilted up to 135 deg. without any interference from floor or pedestal mounting. Can be furnished fully powered with independent motor and controls for table tilt and table rotation. Power for table rotation can be furnished with constant or variable-speed drive. Can also be furnished for manual operation with inde-

"The best records have been made by Pitch and Gravel Roofs"

(in survey of 7,500 roofs on damage by hail)

ROOF DAMAGE by hail usually comes when hail stones puncture raised "blisters" on a roof and thus permit water to enter. This may cause damage not only to the roof, but to the roof deck and to contents of the building as well. What has been the record on this? Here is the latest report:

"OUR ORGANIZATION kept records on damage done to roofs by hail during the five years ending last fall."

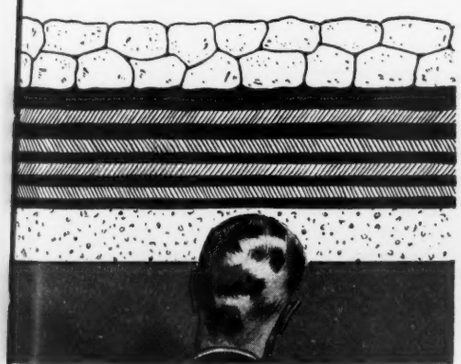
"How many roofs did your records cover?"

"About 7,500."

"WE FOUND INJURY from hail in a considerable number of roofs that were not protected by slag or gravel surfaces. But only one of all the tar and slag or tar and gravel roofs had suffered any damage."

"How serious was the damage?"

"On the roofs without a slag or gravel surface, the average damage was about $1,000.00. On the *one* tar and slag roof, it was less than $150.00."



"WHY did the coal tar pitch roofs do so well?"

"Partly because the slag surface protects them from injury. Partly also because tar roofs have a property known as "cold flow" which enables the tar to self-heal any small surface breaks and thus keep out the water."

"WHEN YOU REALIZE that the tar roof's superior ability to resist hail is coupled with a similar ability to resist wind damage, sun damage, water damage, and fire, you can see how important it is to specify coal tar pitch for your roofs."

WHEN YOU HEAR of built-up roofs that have lasted 20, 30 or 40 years, you usually find they are roofs of coal tar pitch and slag or gravel. That has been no accident. Coal tar pitch has inherent properties that make it best for roofs . . . and for waterproofing.

OTHER KOPPERS PRODUCTS: Tarmac Road Tars for paving drives, parking areas, walks, etc. . . . Bituminous-base Paints . . . Pressure-treated Piling and other timber products.

KOPPERS COAL TAR ROOFING— KOPPERS COAL TAR WATERPROOFING

KOPPERS COMPANY, PITTSBURGH, PA.

use **KOPPERS** *products*

BELTING built for a PURPOSE-

.... and not for a price!

This is what actually results when we manufacture a belt capable of economic power transmission.

If you will but examine OKAY TRED Leather Belting you can readily appreciate that it has a high coefficient of friction and is engineered to assure reduced slippage.

OKAY TRED Leather Belting, our own special tannage, is made pliable to meet today's severe operating demands of high speeds and short center drives. Our experience over the past forty years is built into each roll of OKAY TRED Leather Belting.

Examine a sample of the belting, and you will appreciate the advantages of the specially tanned leather, and the further exclusive Houghton treaded surface. OKAY TRED Leather Belting, priced competitively to first grade oak, will pay you dividends in increased production, reduced maintenance cost and lengthened belt life.

In OKAY TRED Leather Belting or VIM TRED Leather Belting (certified to cost less per unit produced) you will find the belt suited to your exact requirement. Call or write for complete information.

E. F. HOUGHTON & CO.

Chicago — PHILADELPHIA — Detroit

1850 1925 75 years The HOUGHTON LINE

OKAY TRED
LEATHER BELTING

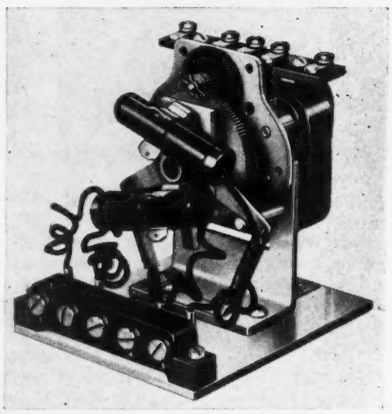
pendent hand wheel for table tilt and table rotation, or a combination of manual and power operation. Said to reduce number of passes required and amount of rod consumption, to permit all work to be done in a horizontal trough, to be self-locking in any set position. Cullen-Friestedt Co., 1300 South Kilbourn Ave., Chicago.

Infra-Red Drying Units

Two units. Model P-7-IR is a bank of seven reflectors which will handle areas up to practically 30 in. in diameter. It can be adjusted to any bank position desired and to a height of from 18 in. to 6 feet. Model P-1-KM is a single reflector unit for use on small flat jobs of paint and enamel repairs. The reflector concentrates infra-red heat energy over an approximate 10-in. circle. Reflector direction is adjustable to any position and to a height of from 18 in. to 6 feet. This unit also lends itself to preheating operations and the thawing of frozen pipe radiators. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Motor Relay

Motorelay, suited to floating or proportioning control of line voltage motors operating large dampers and valves, speed adjusters, voltage regulators, consists of a small reversible geared head, shaded pole

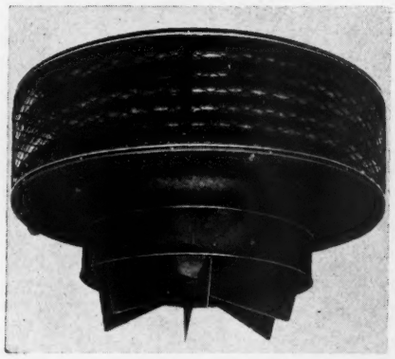


motor which tilts two mercury tubes arranged to give single-pole double-throw operation with spring return to a neutral "off" position. Said to permit throttling, floating, or proportioning control of a 5-amp. load from a sensitive instrument having a current rating as low as 0.35 ampere. Chattering is eliminated because momentary contact at instrument is not sufficient to close the mercury tube switch. Barber-Colman Co., Rockford, Ill.

Sewer and Pipe Cleaner

Electric sewer and pipe cleaning machine can remove stoppages several hundred feet from pipe opening, even when it is necessary to pass through elbows and traps. It revolves different types and stiffnesses of coiled wire "snakes" with various augers and cutting tools attached. Eccentric action of chuck gripping the snakes transmits a whip to the tool work-

ing in the line. Drive is by ½-hp. universal, reversible, variable-speed motor which is hooked up to the spindle pulleys by means of V-belts. A split pulley on the motor can be adjusted so as to lighten the tension on the V-belts, allowing them to slip before the snakes become overstrained in the event that a heavy obstruction is encountered. Machine case and base are of fabricated sheet metal and the machine is mounted on castors. Over-all length, 15 in.; width, 15 in.; height, 14 in.; weight, 85 pounds. The Oster Mfg. Co., 2057 East 61st Place, Cleveland.



Vertical Unit Heater

Vertical-type unit heater for high or low ceiling applications comes in twelve sizes, 30,000-600,000 B.t.u. per hour. Heating elements are designed to operate on steam pressures from 1 to 150 lb. saturated. Can be had with constant-speed, two-speed, or variable-speed motors; two-speed motors are furnished with two-speed controllers, while variable-speed single-phase motors are furnished with transformer controller. American Blower Corp., 6000 Russell St., Detroit.

Gas Torch

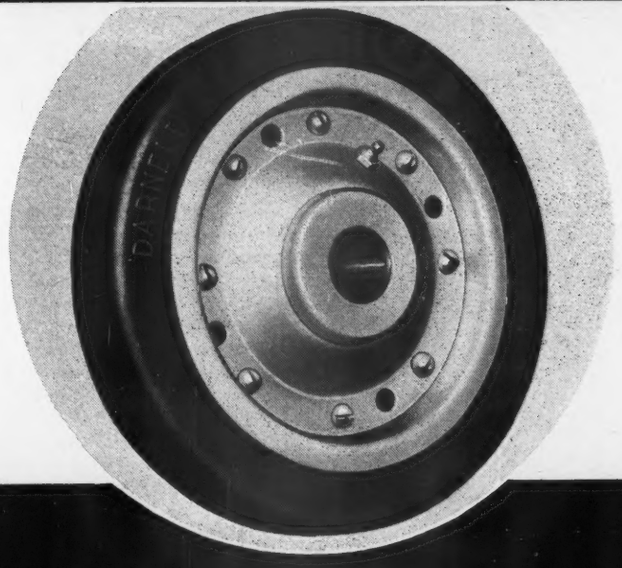
No. 5 gas torch is said to be capable of delivering 200,000 B.t.u. per hour with a flame ranging from 6 to 24 in. in length. Among its uses are soldering copper pipe fittings over 6 in. in diameter, sawing large pipes, crisping paint on stone or brick surfaces, preheating, annealing, heavy copper work on tanks, and such maintenance work as removing rims from generators and melting out worn bearings. Weighs approximately 3 lb. Insto-Gas Corp., 1900 East Jefferson Ave., Detroit.

Hydraulic Atomizing Nozzles

For spraying water, oil, and other liquids with similar viscosities. Spray pattern is hollow cone with uniform distribution and atomization is produced at relatively low hydraulic pressure. Nozzles have polished orifice insert and are available with male and female ¼-in. pipe connection. Capacities range from 1.2 to 17 gal. per hr. at 60 lb. pressure. Stock construction: Brass with 18-8 stainless steel inserts for orifice and core tip, monel metal strainer built in, 18-8 stainless steel throughout. Spraying Systems Co., 4021-D West Lake St., Chicago.

Darnell DOUBLE BALL-BEARING Casters and E-Z ROLL WHEELS

Problems of cost, problems of efficiency, problems of floor protection . . . one good way to handle all these problems at once is to install Darnell Casters and Wheels on all portable equipment.



With Darnell you can specify the exact caster or wheel to meet your requirements. . . . The Darnell line comprises nearly 4000 different models . . . a type for every floor and use. . . . Write for new 192-page Darnell Manual . . . it is yours for the asking.

DARNELL CORP., Ltd. LONG BEACH, CALIF.
36 N. CLINTON, CHICAGO—24 E. 22nd ST., NEW YORK

Below—*Crane sanitary urinals of vitreous china, with integral hooded vents.* Right: *Crane porcelain enameled cast-iron wash sink with spray faucets.*

OUR PRODUCTION PROBLEM WAS SOLVED WITH PLUMBING

In factory toilet rooms, maintenance is minimized and sanitation improved with Crane No. C 11384 Rapidway *closets of vitreous china. Floors are easier to clean. The hard rubber seats resist abuse, and the concealed* Delta *flush valves give a vigorous, blow-out flushing action.*

For some time our output in the assembly plant had been lagging. It was especially bothersome, because we didn't know why. But soon enough the cause came to light. We didn't suspect that the out-dated plumbing in the old assembly building might be a hazard to our production.

* * *

INCREASINGLY, plant managements are realizing that lack of adequate and properly designed sanitary facilities can well be Production Hazard Number One. For, neglect here can lead to excessive sick rolls—high personnel turnover—employee dissatisfaction—reduced efficiency.

With an eye to the beneficial effects on employee relations, and to the betterment of production line performance, alert managements see the advantages of sanitation improvements. They also see the wisdom of modernizing with Crane-Equipment.

Crane offers a complete line of industrial plumbing especially designed for the hard usage of factory service. Crane fixtures embody extra sturdiness that keeps down maintenance costs year after year. They provide the utmost in sanitation and safety for users—as well as practical convenience features which workers appreciate.

The complete Crane line affords proper selection of fixtures for every service need. And Crane research and experience help you plan effective modernization at minimum cost.

You'll profit by reading "Plumbing for Industrial and Commercial Buildings," a Crane booklet which guides you in choosing fixtures, and cautions against improper installation. This book is sent free—on request.

1940 OUR 85th YEAR

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS

PRODUCTION

Rely on

LYON METAL PRODUCTS

taking is simplified. The cost of handling stock is reduced. Tool losses are practically eliminated. Fire hazards are minimized.

Lyon Steel Storage Equipment lasts indefinitely. Changing conditions do not affect its value, because it is quickly adjustable to growing volume or new requirements.

The qualities of convenience, strength, durability and economy, which have made Lyon Equipment the choice of masters of mass production, are characteristic also of other Lyon Products . . . tool cribs, shop boxes, tool toters, shop benches and other equipment that steps up production efficiency.

Mail coupon for detailed information on Lyon Steel Storage Equipment and practical survey service. LYON METAL PRODUCTS, INCORPORATED, Aurora, Illinois.

Wide aisles and good lighting combine with Lyon Standard Shelving to provide accurate filing and efficient handling of thousands of castings stocked in a wide variety of shapes and sizes.

By using the rigid Lyon Standard Shelving installation to support a mezzanine floor, this manufacturer doubled the floor area devoted to storage without additional building investment.

LYON *SHOP EQUIPMENT* *Service*

LYON METAL PRODUCTS, INCORPORATED, Aurora, Illinois

LYON METAL PRODUCTS, INCORPORATED
1210 River Street, Aurora, Illinois

Please send full particulars on Lyon Storage Survey Service. Also data on items checked:

☐ Steel Work Benches; ☐ Shop Boxes; ☐ Bar Racks; ☐ Tool Toters and Materials Handling Carts; ☐ Steel Shelving; ☐ Steel Lockers.

*Name*_____

*Address*_____

*City*_____ *State*_____

Must Model Changes Mean Parts Losses?

(Continued from page 55)

Of course, such a procedure is not suggested for any and all engineering changes or close-outs. In our particular case we have a limit of $1,000 valuation before applying this process. Where the change affects a smaller amount of stock, there is an agreement, usually uncontested, between the engineering and production departments as to the date on which the engineering change shall be ordered to take place.

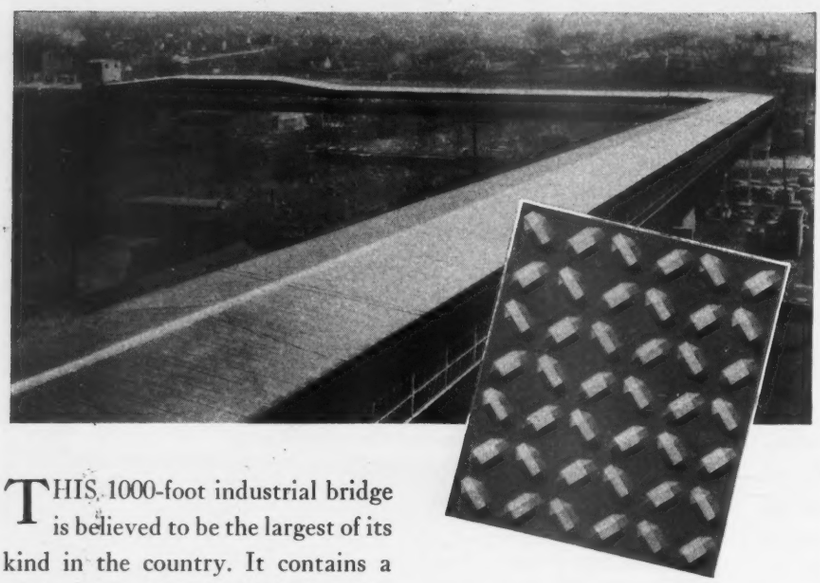
If considerable expense is entailed in the assembly of the product, this information should also be included in the picture as an item of expense (see Curve *4*). In case there is special interest in the actual cash return, our information can easily be rendered as the total actual dollars to be expended against the actual sales dollars (Curves *4–5*). Note that here also there is a point of diminishing returns where the expenditure seemingly parallels the sales line; the dollar spent fails to realize a proportionally greater amount of cash.

Up to this point we have accepted as scrap any material left on hand beyond a point of diminishing returns. It is usually wise to enlarge our horizon to the point of determining the point in sales that will not only make the most of such inventories as might be on hand, but which will also provide for the material that is lost. In such cases a break-even point instead of a point of diminishing returns, must be discovered. This point is found at the intersection of our sales curve (*5*) and the curve denoting ultimate expenditures (*6*). This latter curve is merely a total of curves *3* and *4*—i.e., scrap loss and expenditure for additional parts, assembly, shipping.

There is no limit to the manner in which such information as this can be finally presented. The same principles, however, apply in gathering and extending information in preparing the ultimate picture. The result is a clear, brief, concise accounting of actual conditions, permitting accurate analysis, quick decisions, and prevention of excessive obsolescence and scrap.

NEW INDUSTRIAL BRIDGE

uses 2000 feet of Multigrip Floor Plate



THIS 1000-foot industrial bridge is believed to be the largest of its kind in the country. It contains a double runway of U·S·S Multigrip Floor Plate to take the pounding of traffic and protect the floor from wear.

Multigrip's great strength and light weight make it ideal flooring for installations like this. Its flat-topped pattern assures safe, sure traction in every direction. Wheels of all sizes roll over it readily—do not catch in the risers.

The Multigrip pattern makes cleaning easy, reduces the danger of slipping if floor is wet or oily. Write in for an actual sample of Multigrip and booklet describing its many uses.

MULTIGRIP FLOOR PLATE

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
Tennessee Coal, Iron & Railroad Company, *Southern Representatives*
Columbia Steel Company, San Francisco, *Pacific Coast Representatives*
United States Steel Export Company, New York

UNITED STATES STEEL

"This Is No Time for Politics"

(Continued from page 57)

wishful but fearful—"We can't be any worse off than now!" "Let's give Business a chance" "But how can we be sure we won't lose what we've got?"

It is thus the tremendous seriousness of both the nation's and the individual's security that is behind the campaign's almost complete absence of bitterness and also the comparatively slight weight given by workers to such issues as the "third term" on the one hand, or the "big business-man" on the other. This slight weight is only another proof of the recognized importance of choosing the leader-person who can best do the job—bring most efficiently and most quickly both varieties of the badly needed security.

It is this same seriousness of the choice, also, that explains why few dinner-pail carriers are likely to vote according to the behests of any political, religious, or labor leader—of anybody but themselves as they see their problem and its would-be solver in the light of their experience and their own best thinking about that experience. Few things are surer than that nobody is going to deliver the "labor vote." The reason is that there are too many different kinds of labor-voters—too many varieties of individual labor-voter experience and individual labor-voter ponderings thereon, not to mention too many different "angles" that

YOU CAN MAKE SAVINGS LIKE THIS WITH G-E TIME SWITCHES

$1800 SAVED ANNUALLY IN ONE DEPARTMENT

Here meter coils are dried after dipping. One time switch starts an exhauster. A second switch turns the heater on—and off when drying is finished. Coils can be dried after working hours without an attendant

In this process, the tank is raised to dip meter coils, then lowered to the original position. A time switch controls the operation automatically

We've found out for ourselves that time switches offer one of the best and most economical means of reducing waste and lowering costs. In the meter department of our West Lynn Works an excellent record of savings has been rolled up by an installation of 45 switches.

These switches are used to turn ovens on and off at exactly timed intervals. They operate equipment that pumps explosive fumes away from chemical tanks—safely and automatically. They turn heating units on early—to be ready for use when workers arrive. In some cases they control drying and curing processes after hours—without the attention of an operator.

They're performing dozens of other jobs tirelessly and accurately. In this department alone they're lowering costs $1800 a year.

Time switches can control a great variety of jobs for you—and do it efficiently and economically. Every day that you delay learning more about their applications may be costing you good money. Ask the nearest G-E Office how you can make savings with time switches. General Electric, Schenectady, N. Y.

This time switch turns on a solder pot to bring it to correct temperature before the start of the working day. It also turns the pot off automatically at the end of the day

GENERAL ELECTRIC

603-11

can be suddenly inserted by one Herr Hitler.

The above is far from meaning that American wage earners are all models of restraint and wisdom. Many of them are at this moment certain that "we're going to be pushed into the war, and then there'll *be* no election. That's in the Constitution, isn't it?" Many of them stand convinced that they pay no taxes and need therefore have no concern about appropriations. Others of them are sure that Wall Street and Wall Streeters continue in one way or another to keep piling up just as big profits in depression as in prosperity—that, in fact, they *make* exactly what other people *lose*. Still others now think of social progress as obtainable only through class conflict. Scores of millions of them have so long thought of nothing but job *security* that they have ceased completely to think about job *opportunity*.

Which is to say that while the pre-November discussions are made serious by the glare of London fires, their logic is often weakened by those who carry the deep scars of recent depression experience. The outcome at the polls is impossible to predict because it will be determined by millions of workers who are both *defense scared and depression scarred.*

All the same, I submit that nobody can get close to the current thinking and talking of our dinner-pail voter without feeling that, on the whole, he carries around a thoughtful headpiece and a sound heart. Like all the rest of us he occasionally gets excited and behaves unreasonably and unfairly. But for solid diet he sets a high premium on fairness, perhaps higher than most of us. As sincerely as the rest of us he expects to see "God Bless America" only as he and his fellows work, listen, read, talk, and ponder their present dangers conscientiously.

That's why it's worth while here to pass along to *all* the campaign's managers his favorite present-day remark: *"This is no time for politics!"*

Ryerson Night Loading Assures Quicker Deliveries

It's after hours, at any of the ten Ryerson steel plants, almost any night of the year!

The Ryerson night shift is putting the finishing touches on *today's* orders; loading out the fleet of big, red Ryerson trucks for tomorrow's deliveries.

***Immediate Steel* is a Ryerson tradition. The entire Ryerson organization is geared up to handle *quickly* the steel requirements, simple or involved, of thousands of customers the country over. Special telephone order desks, hourly mail pick-ups at the post office, telegraph and teletype lines right into our offices—all help to speed delivery, even *before* the order reaches us.**

Night loading to "clear the decks" for tomorrow's new crop of orders is the regular course of business. Every order is RUSH at Ryerson—most are shipped the day received.

Ryerson Steel Service is fast and sure; Ryerson Certified quality is your assurance of uniformity and exactness. Make the Ryerson Stock List your unfailing source for all steel requirements. If you haven't the latest Stock List we'll send one gladly.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

RYERSON CERTIFIED STEELS

RYERSON

Pete Gets New Slant on New Methods

(Continued from page 55)

how many cars there are parked out here. Why, it's nearly a block to my car. In the old days there was a handful of cars of ancient vintage and a few shiny new cars owned by the big shots."

It struck him, as he approached his nearly new sedan, that he had as nice a car now as the big shots had in the old days. And then, there were George Pierce and Al Green with their brand new Chevies and many other year-old models.

Can Buy a Car for Half

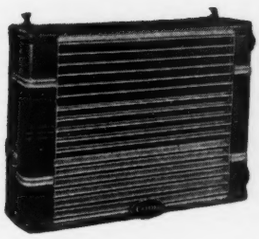
"Well," Pete reminded himself, "a fellow can buy a car now for half what it cost in the old days. Not only that, but the cars are built better now then they were then, even though they cost less. Let's see, how did the salesman explain this to me when I bought my car? Something about improved methods of manufacturing I think he said."

"Improved methods." This term kept popping up in Pete's mind while he was starting his car and pulling out of the parking lot into the street. "I guess I'll pick up Marian when she gets out of school," he decided. "Gosh, it doesn't seem like Marian is old enough to be in high school already. They sure grow up fast."

Then it struck Pete how odd it was that he was getting out of work in time to take the kids home from school. Three-thirty and a day's work done. Why there were five hours more of daylight—thanks to another of those new methods, daylight saving. In the good old days, it was usually eight-

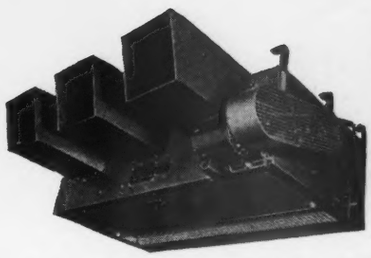
Here's the Answer to Your Heating Problems

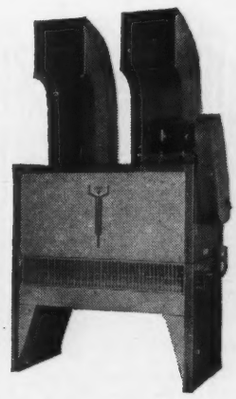
Carrier Unit Heating



For Small Spaces — 22 sizes — 24,000 BTU to 450,000 BTU.

Gas Fired—6 sizes —45,650 BTU to 166,000 BTU.





For Large Spaces — 20 sizes — 110,000 BTU to 900,000 BTU. Models for floor or ceiling installation.

Read these facts about CARRIER UNIT HEATING

- ★ ***Non-ferrous Steam and Water Coils***—all joints silver brazed, tested to 1,000 pounds hydrostatic pressure, guaranteed to 200 pounds working pressure. Exclusive U-Bend construction permits free expansion and contraction.
- ★ ***Balanced Fan Assemblies***—low operating speeds, sound-and-vibration-absorbing mountings.
- ★ ***Thermajust Control***—available on industrial centrifugal fan models, balances heat output against building requirements, reduces overheating of upper areas — thereby reducing fuel consumption to a minimum.
- ★ ***Smart Styling***—smaller models in smooth finish lacquer with aluminum trim—larger models in smooth finish two tone lacquer.
- ★ ***Variety of Sizes and Types***—4 types, ranging in capacity from 24,000 BTU to 900,000 BTU.
- ★ ***Variety of Styles***—Floor mounting, ceiling or wall suspension, Steam, Hot Water or Gas.

Cuts Costs . . . Gives Greater Comfort

COMPARED with ordinary methods of heating, Carrier Unit Heating cuts operating costs up to 25%—reduces maintenance costs as much as 25% — and frequently saves 50% or more on your original investment.

These facts alone make it worth while to investigate Carrier Unit Heating. And think of the *extra* features this method of heating provides:

Quick Heating—working space is heated in quick *minutes* instead of long *hours*.

Greater Comfort — heat is directed exactly where required.

Greater Convenience—temperature control can be fully automatic, requiring practically no attention whatever.

Carrier Unit Heaters are available in a wide variety of styles and sizes. You're sure of the proper type for any desired location—for most efficient performance — for greatest space-economy in your factory—year in and year out.

You'll find it well worth while to mail the coupon below, or to call your local Carrier representative for complete information on Carrier Unit Heating. Do it today and get the facts!

Call Air Conditioning by its *First Name* — Call CARRIER

CARRIER CORPORATION Desk 6J
"Weather Makers to the World"
Syracuse, N. Y.
(In Canada: 30 Bloor St. West, Toronto, Ont.)
Send me the latest catalog on ☐ Carrier Unit Heaters ☐ Heat Diffusers ☐ Gas-Fired Heaters.

Name.....

Company.....

Address.....

thirty, four days a week and plenty of alibis to get off on Saturday afternoon during the rush season.

"But," Pete smilingly reminded himself, "the paychecks were really something in those days. Why, one year I made over two thousand bucks. That was sweet money, even if I did work ungodly hours for it."

"Let's see," he reflected, "how much did I make last year? It isn't hard to figure. My Christmas bonus check was for $165. That was nine percent of my earnings. My yearly wages would be over $1,800, plus my bonus of $165 is a total of $1,965.

"By gosh," exclaimed Pete in astonishment, "I didn't realize I made that close to my 1928 figure. And working only 40 hours a week, too. That doesn't add up right. How can that be possible?"

Pete then considered this seriously for the first time. He recollected that the winter time was a mighty slack period around the plant in the old days. Ten and fifteen-dollar paychecks for two weeks were not uncommon in the off season. He recalled an article he had read in a current magazine about the effort being made in industry to eliminate business cycles and to spread the work over the entire 52 weeks. As he remembered, there was quite a bit in the article about improved methods in warehouses and distribution. However, Pete had not tied this up with the fact that his plant now enjoyed a reasonably busy season during the winter months.

Pete picked up his daughter at school and proceeded on home. Parking his car in the driveway, he went into the house to see how Mary, his wife, had progressed during the day. Mary was rarely grouchy when she greeted him these days. The new stoker had relieved her of a great responsibility in keeping the furnace going right. Pete just couldn't escape this improved method thing.

He had to get it off his chest so he told Mary about the great injustice that had been done him at work. Mary obligingly sympathized with him but told him not to worry as they could cut down their budget if his earnings were going to be less.

"Oh, we won't have to do that yet," Pete assured her. "I can still make out all right under the new rate; it's just the principle of the thing that gets me."

"Well," Mary asserted proudly, "we can cut down some on the budget anyway. I've been listening to the radio lately, and I've found several programs that point out improved methods of housekeeping, and they lead to quite a saving around the house."

Getting Pete Down

About this time, this "improved method" stuff was beginning to get Pete down. It was thrust at him from all sides. But he was still not quite convinced.

The evening meal was the opportunity for a general discussion of the day's affairs at the Plunkett home. Of course, the children were bubbling over with enthusiastic news about school. Pete, Jr., was exuberant over some new manual training equipment his class had just started to use. He said that teacher told them that new equipment was necessary every once in a while to keep up with new developments in woodworking.

Marian was anxious to tell about the grand new sewing machines they received at high school. Teacher said that machines were cheap enough now so that every girl could have her own individual machine at class time.

Pete Plunkett began to wonder if there was any place to which he could retreat and not hear about new methods. He decided to seek solace in his favorite evening pastime, his new radio. Even while operating the various gadgets for automatic tuning, wave bands, and so on, he had to admit that new

p&h ELECTRIC CRANES

Capacities from 5 to 300 Tons

• Whatever your particular task in the handling of heavy materials may be, you can be sure they will be thoroughly understood by P&H crane engineers. As America's leading builders of overhead handling equipment, more than 50 years' experience in building more than 10,000 electric cranes is at your command. To meet your requirements in the most prompt, efficient manner, call in a P&H engineer.

America's Oldest and Only Crane Builder Producing Complete Electrical Crane Equipment.

General Offices: 4525 W. National Ave., Milwaukee, Wis.

HARNISCHFEGER CORPORATION

ELECTRIC CRANES • EXCAVATORS • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

Condor Compensated Belt . .

PATENTED
TRADE MARK REGISTERED

12* Aids to *Uninterrupted* Production

WITH nearly all manufacturing linked to the Defense Program, Condor Compensated Belt has twelve* significant advantages.

They include a high overload capacity, greater margin of safety and high production efficiency—because operation is uninterrupted by the need for frequent take-ups, pulled or broken fasteners or premature belt failure. These all add up to production *and* economy.

Also available in Type F where rubber friction pulley surface is desired, and Type B where some slip is necessary. All these types described in Bulletin 6808-C. Write for your copy.

12* ADVANTAGES

1. Ruptures in outside ply eliminated.
2. Freedom from ply separation.
3. Longer fastener life.
4. Can be operated on smaller pulleys.
5. Less bearing, shafting and hanger troubles.
6. For heavy loads, plies may be increased with same pulleys.
7. Operation less affected by atmospheric conditions.
8. Higheroverload capacity or margin of safety.
9. Less wear on pulley side.
10. Can be dressed without injury to belt.
11. High production efficiency.
12. Material reduction in belting costs.

Condor PRODUCTS

Compensated Belt
Conveyor and Elevator Belt
V-Belt
Transmission Belt
Agricultural Belting
Air Hose
Acid Hose
Fire Hose
Oil & Gasoline Hose
Steam Hose
Contractors Hose
Hydraulic Hose
Sand Blast Hose
Suction Hose
Water Hose
Molded Rubber Goods
Rubber Lined Tanks
Rubber Covered Rolls
Chute Lining
Launder Lining
Industrial Brake Blocks and Lining

Abrasive Wheels
Bowling Balls

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.
33 Townsend Street • Passaic, New Jersey
Birmingham Chicago Cleveland New Orleans New York Boston
Minneapolis Detroit Pittsburgh Philadelphia St. Louis San Francisco

developments had certainly revolutionized the radio field.

His first program was that of a dentrifice manufacturer. Its keynote was word of a new improvement that made the product more effective at no increase in price. The next program was that of the manufacturer of Pete's favorite cigarette. The announcer extolled the merits of government experiments in the tobacco fields, which had vastly improved both the quality and the quantity of the tobacco crops.

Pete weakened. He was beginning to see that there was something to this new method idea. He was starting to realize that it was not a deliberate war on the employee's wages, but rather a means of providing the working man, in his role of consumer, with higher-quality, up-to-the-minute products at lower prices, prices within the reach of a far greater number of the working class than has ever before been possible. His reaction was similar to that slang expression, "Why doesn't somebody tell me these things?"

Pete was not one to follow a halfway course. He had the courage of his convictions. He called Mary in from the kitchen and explained his change of heart and mind regarding the company's program of improvement and progress.

"Mary," he said, "I guess maybe I've had the wrong slant on these changes that are taking place at the plant. I'll have to hurry to catch up with those fellows who saw the light before I did. I'm going in there in the morning with some new ideas of my own."

As Mary returned to the kitchen, she could hear him mumbling to himself—"and the idea of that helper of mine making those remarks about our company today. Just wait till I see him tomorrow. I'll teach him a few lessons in loyalty."

And that is the end of the story of Pete Plunkett. But, believe me, Pete's job will be much more interesting and less monotonous than before his awakening.

•

GREATEST "BUY" IN DRILL HISTORY!
SKILSAW
½ in. SPECIAL DUTY DRILL
100% ANTI-FRICTION BEARING CONSTRUCTION FOR ONLY . . .
$44
Weighs Only 8 LBS!
ONLY 3½" WIDE

LOOK at these features and you will decide to BUY! Compact, modern die-cast body, helical-cut gears for smooth performance. 2-pole safety switch. Every moving shaft mounted on a friction-free ball or needle-roller bearing. Powerful Universal motor for fast drilling.

The new SKILSAW Model 80 DRILL *belongs* in your plant . . . *it is the biggest drill value* on the market today! Ask for a demonstration.

SKILSAW, INC.
5043 ELSTON AVENUE, CHICAGO

36 E. 22nd St., New York; 182 Main St., Buffalo; 52 Brookline Ave., Boston; 15 S. 21st St., Philadelphia; 2902 Euclid Ave., Cleveland; 2124 Main St., Dallas; 918 Union St., New Orleans; 1253 South Flower St., Los Angeles; 2065 Webster St., Oakland; 29 North Ave., N. W., Atlanta; Canadian Branch: 85 Deloraine Ave., Toronto.

SKILSAW
SAWS · BELT SANDERS · GRINDERS · BLOWERS · DRILLS · DISC SANDERS · FLOOR SANDERS
PORTABLE ELECTRIC TOOLS
SEE YOUR DISTRIBUTOR —he will gladly demonstrate how SKILSAW TOOLS will save you money

BOOKS

SIMPLE BLUEPRINT READING

The Lincoln Electric Co., 12818 Coit Road, Cleveland. 138 pages, illustrations, diagrams, symbols. 50c in the United States, 75c outside.

Printed last year in mimeograph form, the information is now contained in a bound book. Placing the emphasis on welding and welding symbols as standardized by the American Welding Society, this book purposes to give the reader a sound basis in the fundamentals of blueprint reading and a working knowledge of the various symbols used in drawing different types of welded joints. The text is supplemented with 164 illustrations of machine parts, pipe connections, general construction, tanks. A list of questions and answers is included.

PRODUCTIVITY OF LABOR IN RUBBER TIRE MANUFACTURING INDUSTRY

John Dean Gaffey, Instructor in Economics and Business Administration, Rensselaer Polytechnic Institute. Columbia University Press, Morningside Heights, New York. 204 pages, tables, bibliography, index. $2.50.

Examination of the technological and economic history of the rubber tire manufacturing industry from the standpoint of productivity is confined to the industrial efficiency of that industry. Discussion covers environmental factors favoring industrial progress, a measurement of changes in productivity of labor in tire manufacture since 1914, analysis of conditions attending these changes and an appraisal of responsible factors, a description of the principal effects of these changes upon our economic society including a study of the distribution of the gains resulting from the productivity increase, an attempt to predict the probable future course of labor productivity in the industry.

WAGE DIFFERENTIALS THE CASE OF THE UNSKILLED

Carrie Glasser. Columbia University Press, Morningside Heights, New York. 169 pages, tables, bibliography. $2.

Feeling that a knowledge of the nature and causes of wage differentials in the labor market is prerequisite to an understanding of the economic consequences of wage legislation, the author has delved into the problem of wage differentials. She discusses the persistence of differentials in wages among workers of similar skill in various industries and geographical sections of the United States, differences in rates of pay and annual earnings, dispersion of wages,

MAKING HISTORY

. . . the ONLY motors with rotor windings centrifugally cast of COPPER!

Fairbanks-Morse Motors with centrifugally cast rotor windings of *solid copper* are making history. That's natural. Every industry that uses motors has long needed the thermal and electrical characteristics that only motors with one-piece rotor windings of solid copper can provide. Every motor manufacturer has tried for years to build such a rotor. Many made centrifugally cast windings of OTHER metals—but NOT of *copper*.

Then Fairbanks-Morse did it. It took time and money. But the result is worth the cost. Fairbanks-Morse now gives industry a better motor capable of standing up under certain conditions of *severe* service that no other motor could long endure. This motor reduces operating cost. It provides more years of trouble-free operation. It is worth investigating if you use motors. Write Fairbanks, Morse & Co., Dept. 30, 600 So. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

7854-EA40.15B

Copperspun

FAIRBANKS·MORSE MOTORS

DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

general factors bearing on wage differentials, causes of imperfect labor mobility, regional differences in labor market conditions.

THE BOTTLENECKS OF BUSINESS

Thurman W. Arnold, Assistant Attorney General of the United States. Reynal and Hitchcock, Inc., 386 Fourth Ave., New York. 335 pages, index. $2.50.

An exposition of the economic philosophy underlying the series of prosecutions of monopolies engaged in by the Department of Justice under the author's leadership plus an analysis of some of the principal cases involved. Purpose is to explain to the consumer what can be done to increase the flow of goods under existing laws and by following the American tradition of free private enterprise. Procedure under the Sherman Act, how it operates, is the subject of one chapter. Some of the other chapters deal with such topics as the basic problem of distribution, how restraints of trade affect your standard of living, how they unbalance the national budget, a free market in time of national emergency or war, clarification of the anti-trust law through public enforcement, bottlenecks between the farm and the table, labor—restraints of trade among the under-dogs, rise of a consumer movement.

THE DEAD HAND OF BUREAUCRACY

Lawrence Sullivan. The Bobbs-Merrill Co., 468 Fourth Ave., New York. 303 pages, tables, bibliography, index. $2.50.

Analytical treatment of the growth of American bureaucracy emphasizes the increase in federal personnel, taxes, and debt; the expanding range of government interference with the social adjustments of free enterprise; the enlargement of bureaucratic regulation against abuses of economic power to the ultimate concept of managed economy where government defines the channels of economic activity. It catalogs encroachments of political spoils upon public administration and touches upon gradual mobilization of a political party of office-holders and patronage beneficiaries. Solutions to end the present economic control by government and to restore to private enterprise its place under a constitutional arrangement of checks and balances in public power are discussed.

INDUSTRIAL RELATIONS IN WARTIME GREAT BRITAIN, 1914–1918

Bibliography compiled by Waldo Chamberlin, prepared under direction of the Division of Industrial Relations, Graduate School of Business, Stanford University, Palo Alto, Calif. 239 pages, index. $3.

Bibliography of materials in the Hoover Library on War, Revolution, and Peace makes available a possible source of information on the experience of Great Britain with the problems of industrial relations during 1914–1918. Covers society and periodical publications, general works, specific problems, labor and employer views and organizations, employer-employee relations, state control and regulation, biography.

GOVERNMENT AND ECONOMIC LIFE

Leverett S. Lyon and Victor Abramson. The Maurice and Laura Falk Foundation, Farmers Bank Building, Pittsburgh. 66 pages. 25c.

Interpretative summary of the Brookings Institution two-volume study entitled *Government and Economic Life* discusses basic ideas, private enterprise and its implementation, regulation of private enterprise—protecting competition and creating a plane of competition, special treatment of particular industries and on particular occasions, direct production by government, current trends and questions.

INDUSTRIAL DISPUTES AND FEDERAL LEGISLATION

Thomas Russell Fisher, Associate Professor of Social Legislation, Syracuse University. Columbia University Press, Morningside Heights, New York. 370 pages, bibliography, index. $4.75.

Approaching the development and present position of federal labor legislation, 1900-1939, from the historical, comparative, and critical angles, the author aims at a clearer understanding of federal legislation that the law and its administration may be improved. Labor disputes are discussed with particular reference to such typical industries as the coal, steel, railroad and automobile industries. Consideration is given to the evolution of a national labor policy finding expression in labor legislation. How the machinery of government was applied to changed economic and social conditions in the adjustment of our industrial organization is shown. Discussion of federal legislation attempts to analyze the laws and give some account of conditions leading to their passage. Where state legislation is involved, it also is analyzed. For comparison and contrast, reference is made to the legislation of Canada and Australia.

TROUBLES OF ELECTRICAL EQUIPMENT

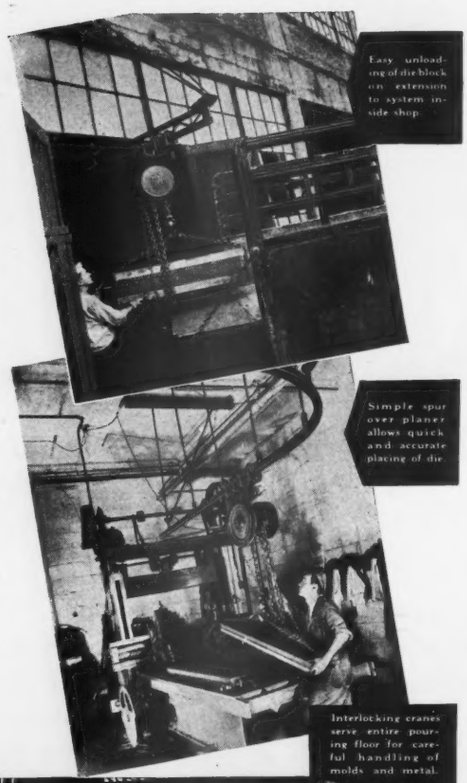
H. E. Stafford. McGraw-Hill Book Co., 330 West 42d St., New York. 373 pages, diagrams, tables, illustrations, index. $3.

Second Edition. Covers symptoms, causes, and remedy of troubles of both a. c. and d. c. apparatus usually found in the average industrial plant, hints on efficient operation and maintenance. Necessary changes have been made to bring all information up-to-date, and the chapter on industrial plant lubrication was rewritten. The last chapter, 43 pages, is a new one. It discusses determination and location of cable faults. The book is a how-to-do-it job manual for the electrical maintenance man.

Simple Methods for stepping up DEFENSE PRODUCTION

With a surging demand for greater output, plants operating on defense materiel use every possible means to obtain it. It is no wonder that these plants are rapidly installing overhead handling equipment to relieve floor congestion — to gain time through process aids — or to conserve skilled manpower by eliminating handling fatigue.

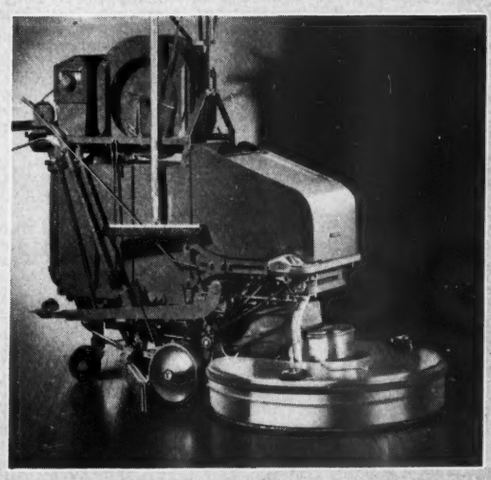
Simple systems as shown here are quickly and inexpensively applied wherever a short cut is needed. American MonoRail engineers can spot these places in a short survey of your plant. They will then offer a detailed proposal which does not obligate you in any way. Why not give them a chance to help push along your defense production?


Easy unloading of die block on extension to system inside shop
Simple spur over planer allows quick and accurate placing of die
Interlocking cranes serve entire pouring floor for careful handling of molds and metal

THE AMERICAN MONORAIL COMPANY

13114 Athens Ave. Cleveland, Ohio

One of Industry's Costliest Hazards



SLIPPERY NEGLECTED FLOORS

In seven of our States alone, more than $8,000,000 was paid in compensation for falls (1938 cases), according to the figures given in *Accident Facts* for 1940 and based on the reports of seven State Labor Departments or Industrial Commissions.

Since a large percentage of the falls was due to slippery floors, obviously there is real need for more thorough maintenance methods, for equipment adequate to the job of keeping floors free from dirt, oil, grease, and other slippery substances.

That's where *Finnell* comes in. With a range of 49 different sizes and types of equipment, *Finnell* is prepared to offer a solution even to the most difficult of floor-maintenance problems . . . in particular, to *your specific problem.*

Let us show you how a *Job-Fitted Finnell* can aid you in your safety program and keep maintenance costs at *rock bottom.* Demonstration on your own floors involves no obligation. Phone nearest *Finnell* branch, or write Finnell System, Inc., 2510 East Street, Elkhart, Indiana.

Note: The top illustration at left shows a heavy duty *Finnell* for hard-to-clean floors. Its two scarifying brushes dig through and completely remove embedded accumulations. The other illustration shows a *Combination Finnell* for large open-area floors. This *Finnell* does the complete cleaning job, — scrubs, rinses, and dries the floor.

FINNELL SYSTEM, INC.

Pioneers and Specialists in FLOOR MAINTENANCE EQUIPMENT

Carrier Head Sees Challenge To New Growth

J. I. Lyle of air conditioning fame sees a challenge to his own young, fast-growing industry in the history of America's vast automobile trade.

And so at the 25th anniversary dinner of the Carrier Corporation of Syracuse, President Lyle declared that air conditioning, too, can grow rapidly and hugely by "continually giving the public a greater value and a greater service for dollar expended."

"If some of you are old enough to remember the cars that were sold to the public in 1905 for prices ranging from $5,000 to $10,000 and compare them with the car that you can buy today for $1,000 you will appreciate what I mean by what the automotive industry has accomplished," he said. The price is one-fifth, but the car is five times as good—a difference of 2,500 percent.

"The automotive industry has helped to make the lives of millions of people happier," he declared. "Our industry is one that is contributing to the health and happiness and comfort of mankind. No longer is it necessary for anyone with a few hundred dollars to bear the high temperature of our summers.

"For centuries in this country and for many others it has been the custom to heat some homes to various degrees of comfort. In this country we have heated to comfort a greater percentage of homes than any other. But air conditioning is improving the heating conditions by controlling the humidity as well as the temperature. Our refrigeration is not only contributing to the preparation and preservation of foods and other necessities of life, but, along with air conditioning, is improving the manufacturing processes of many products and making them cheaper so that more people may enjoy their benefits."

Carrier employees were warned by Mr. Lyle to keep an eye open for evidence of fifth column activities. The company will play a role in the national defense program. During the World War it equipped with air conditioning many plants for the manufacture of aircraft, fuses, ammonia nitrate, star shells, and other products.

Dr. Willis H. Carrier, chairman of the board, was present at the anniversary dinner at which 15-year employees were presented with gold pins.

•

ON THE CALENDAR

OCTOBER

7–11, National Safety Council, Annual Meeting, Chicago. W. H. Cameron, Managing Director and Secretary, 20 North Wacker Drive, Chicago.

13–15, First National Convention of Industrial Editors, St. Louis. Howard A. Marple, Chairman in Charge of Convention Arrangements, Monsanto Chemical Co., St. Louis.

14–15, American Society of Heating and Ventilating Engineers, Fall Meeting, Houston, Texas. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

16–18, Porcelain Enamel Institute, Fifth Annual Forum, University of Illinois, Urbana, Ill. C. S. Pearce, Secretary, 612 North Michigan Ave., Chicago.

21–25, American Welding Society, National Metal Exposition, Annual Meeting, Cleveland. Miss M. M. Kelly, Secretary, 807 Riverside Drive, New York.

27–Nov. 1, National Electrical Manufacturers Association, Annual Meeting, New York. W. J. Donald, Managing Director, 155 East 44th St., New York.

NOVEMBER

8–9, National Time and Motion Study Clinic, Third Meeting, Chicago. W. F. Entorf, Publicity Chairman, Industrial Management Society, 421 Engineering Building, 205 West Wacker Drive, Chicago.

12–13, American Management Association, Production Division, Autumn Conference, Cleveland. H. J. Howlett, Secretary, 330 West 42d St., New York.

DECEMBER

2–7, Fourteenth National Exposition of Power and Mechanical Engineering, New York. Charles F. Roth, President, International Exposition Company, Grand Central Palace, New York.

5–7, Society for the Advancement of Management, Annual Meeting, New York. Miss Evelyn Buckley, Secretary, 29 West 39th St., New York.

9–13, National Association of Manufacturers, Annual Meeting, New York. Noel Sargent, Secretary, 14 West 49th St., New York.

THE spider builds his web with one *continuous* thread and he starts or stops at will *without breaking* the thread.

Drawing wire through a series of dies and motor-driven spindles is equally delicate. The individual motors for all spindles must function *as one motor*—and this is accomplished by a simple control—developed by EC&M for this purpose. The operator can start or stop at will . . and superior operating results are being obtained in drawing high carbon wire by this system.

This is typical of EC&M Control—control that is *engineered* to the task. Put your motor control problems up to EC&M.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS

THE ELECTRIC CONTROLLER & MFG. CO.
2700 E. 79th Street Cleveland, Ohio

An Effective Defense Against Excessive Costs

For Your Convenience Century Motor Specialists are located in these key centers—

Atlanta • Baltimore • Boston
Buffalo • Chicago • Cincinnati • Cleveland • Dallas
Davenport • Denver • Detroit
Houston • Indianapolis • Kalamazoo • Kansas City • Los Angeles • Milwaukee • Minneapolis • New Orleans
New York • Omaha
Philadelphia • Pittsburgh
Rochester • Salt Lake City
San Francisco • Seattle
Spokane • Tulsa

In addition there are 70 points in foreign countries where you can obtain engineering advice and assistance on Century Motor driven equipment.

Excessive production and maintenance expenses have no place on the cost sheets of industry today. Yet using out of date, misfit motors on your equipment often results in unnecessary costs that penalize production efficiency and profits.

Modern engineering, particularly in the machine tool field, requires the selection of an electric motor having starting and operating speed and torque characteristics that accurately match the load requirements of the driven machine and the surroundings in which it must operate. Century Motors are designed to properly fit the load requirements of the machines they drive — to contribute to maximum production, and improved performance, at the lowest cost. Call in the Century Motor Specialist nearest your office. He's trained to analyze your motor problems. Century offers you and your engineers the widest selection of motor types and sizes, from fractional to 600 horsepower.

Industry has found that Century Motors, properly selected and applied, are a vital factor in keeping production moving smoothly and holding costs at a minimum.

For 37 years the Century organization has worked closely with American industry. Its experience and that of its national field organization is always at your service.

CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Missouri

One of the Largest Exclusive Motor Manufacturers in the World

Ask this Man

ABOUT THE *NEW* "LINE-UP" ON

WIRE & CONDUIT

Wondering about the new types of small diameter building wire and how they fit into your picture? Your GRAYBAR Man knows the story complete. » » » Because GRAYBAR handles all types of standard and small diameter building wire: RHT, RPT, RU, SN . . . your GRAYBAR Man has no "axe to grind". He's ready with factual information on how to make the best use of each type under the new Code. What's more, GRAYBAR stocks are set to give you the wire you want *when you want it.* » » » For both rigid and flexible conduit, too, you'll find GRAYBAR a first-rate source of supply and an up-to-the-minute source of information on fields of service for every type and grade. If you're not yet acquainted with the new "Inch-Marked" Electrunite Steeltubes, for example, you'll want to check on this particularly. Call your local GRAYBAR office or write direct for information to Graybar Electric Company, Graybar Building, New York.

Are you taking advantage of GRAYBAR'S "one-call" supply service to save your buying time on any one of 60,000 electrical items?

ADEQUATE WIRING SERVES AND SAVES

They Say and Do

Conference Board Studies Employment of Aliens

The knotty problems arising from employment of aliens are reviewed in a recent publication of the National Industrial Conference Board. A survey of the policies of 149 companies—mostly metal-working firms likely to be engaged in or allied with defense work—is presented by the board in number 24 of its valuable series, "Studies in Personnel Policy."

Ninety-three of these companies restrict employment to citizens, the survey showed. In 30 percent of the remaining companies, aliens constitute only 1 percent or less of the total working force. In only 4 plants did the proportion of aliens run above 20 percent. The highest was 27 percent.

It may thus be seen that the problem is not so large as it is complex. The majority of managements were shown in the survey to be eager to deal justly with their alien employees while properly safeguarding their own and the national interest.

Two government regulations have done much to narrow the issues. One is the stipulation that no aliens be employed in work on direct defense contracts. The other is the new Alien Registration Act requiring all non-citizens to be fingerprinted and tabulated.

The questions remaining to the companies concerned are whether to keep or drop aliens already on the payroll and whether to refuse employment to alien applicants in the future. No rule of thumb appears to obtain here, the decision resting more often with the demands of simple justice in the individual case.

"The establishment of arbitrary employment restrictions encountered complications," the board pointed out. "Unnaturalized citizens had often been employed for many years. In some cases there were good reasons why they had not qualified as citizens. The literacy test had frequently been a stumbling block. But these people were known to be loyal to American principles and faithful and efficient workers. . . .

"If all companies barred non-citizens from employment, then how would these workers support themselves and their families? Such sudden discrimination might be the surest way to turn them against a system that, for no actual offense on their part, left them economically stranded and helpless."

The survey revealed some tendency on the part of management to renew the Americanization programs of post-war years by aiding trusted alien employees in obtaining citizenship. In addition, a number of the companies were found to have made discreet check-ups to satisfy themselves of the employee's loyalty to American principles.

"Citizenship alone does not insure loyalty," the survey pointed out. "It is a person's political and social philosophy, not his birthplace, that makes him either a constructive member of American society or a potential or actual saboteur working for the destruction of democratic institutions."

The Conference Board study also reviewed plant protection methods used by 144 typical companies. The survey revealed that 85 companies did not consider it necessary to use employee identification devices. Of the remainder, 30 used numbered metal badges; 11, photographic badges; 4, photo passes; 8, cards; 2, buttons; 3, pass checks; and 2, signature passes.

•

Westinghouse Reports "Biggest Month"

Big orders, both for peace and preparedness, gave Westinghouse Electric & Manufacturing Company its "biggest month" in August.

As Westinghouse employment neared the peak figures of 1929, President George H. Bucher announced the booking of $57,352,054 in orders for the month—68.8 percent above July and substantially higher than the previous "best" month, October 1917, when orders of $50,000,000 were booked.

The national defense program accounted for $36,000,000 of August's big volume, including $21,000,000 for propulsion turbines and gears, switchboards, and auxiliary equipment for marine service; $11,000,000 for gun equipment for the Navy; and $4,000,000 for radio equipment for various branches of the government.

Without all this, August would still have been a good Westinghouse month. Its $20,000,000-plus in peacetime orders was decidedly above average. In fact no month of 1929 exceeded $25,000,000.

Accordingly Westinghouse announced plans for an $8,500,000 expansion program, as the "Help Wanted" sign went up at the gates of its plants. At the start of August 52,000 persons were on its payrolls, 9,000 more than in August 1939. At East Pittsburgh the company

TOWMOTOR BRINGS YOU

A THRIFTY NEW MACHINE TO REDUCE HANDLING COSTS

PAYS ITS WAY IN MORE WORK PER DAY

It's a fact that *any* lift truck costs *less* to operate than you pay the driver. So naturally, your best buy is the truck that moves the *most tonnage* per hour, per day. That's Towmotor because Towmotor *travels faster, lifts faster* than any machine in its class. Keeps hustling at peak capacity 24 hours a day, with less time out for servicing.

Picks Up 1000 to 3000-Lb. Loads • Whisks Them 250 Ft. in 30 Seconds • Stacks Up to 11 Ft. High in 16½ Seconds!

Here's just the machine you need right now to speed production and cut the cost of handling 1000 to 3000-lb. loads. It's the Towmotor LT-40 . . . *small* (only 35″ x 70″), *light in weight* (only 3000 to 4000 lbs.) with a 68″ turning radius. Yet there's a world of power, speed and endurance packed into its 40″ wheelbase.

A bear for punishment, this mighty little LT-40 lifts, hauls and stacks all kinds of materials "from soup to nuts". . . loads and unloads box cars, trucks . . . does scores of other back-breaking handling jobs faster, easier, and at less cost per ton. Best of all, you'll find the Towmotor LT-40 *thrifty to buy* . . . thrifty to operate . . . thrifty to maintain. Its compact, streamlined design and advanced engineering improvements assure *easier accessibility* to all working parts.

Sound interesting? Then don't delay. Mail the coupon now for a free copy of "*The Answer to Lower Handling Costs*"—a new 16-page illustrated bulletin that spreads all the money-saving facts before you. Address inquiry to Towmotor Co., 1270 E. 152nd St., Cleveland, Ohio.

"MAN! WHAT COMFORT —AND A LOT SAFER, TOO!"

No wonder operators are strong for the new LT-40. They get more work done, feel less tired because they can *relax while they work* in a roomy, comfortable upholstered seat—with ample leg room and improved visibility. What's more, this agile little machine is easy to get on and off—handles so simply a child could steer it—turns on a dime in close quarters. And with Towmotor's seated center control, there's no danger of injuries from backing into posts, machines, or stock piles. The driver is *safe* behind a solid bulwark of steel.

Get this book

Let TOWMOTOR (CLEVELAND) *take the load off your hands*

TOWMOTOR CO.
1270 E. 152nd St.
Cleveland, Ohio.

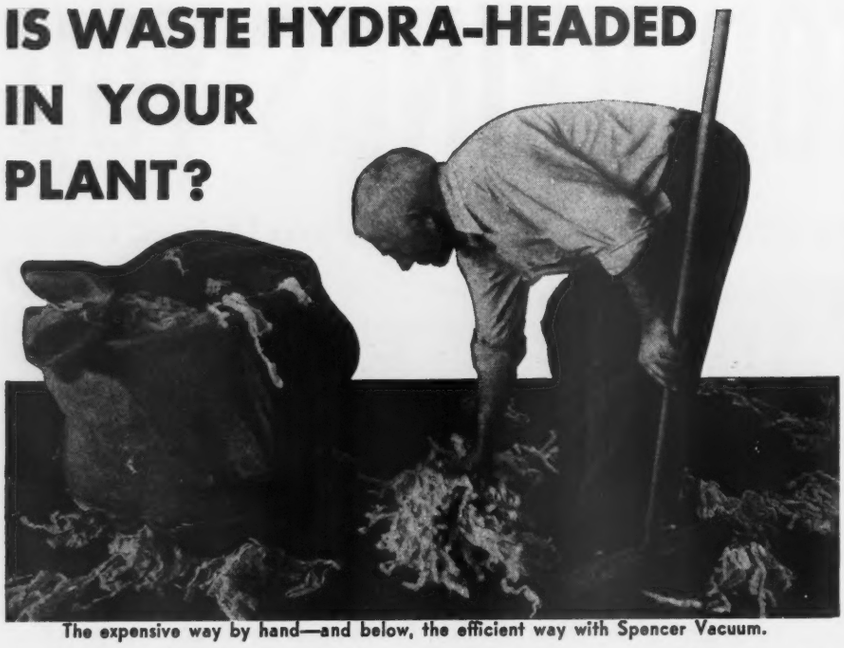
Gentlemen: Please send your new 16-page book, "The Answer to Lower Handling Costs."

Name_____

Title_____

(Please attach coupon to your business letterhead.)

IS WASTE HYDRA-HEADED IN YOUR PLANT?



The expensive way by hand—and below, the efficient way with Spencer Vacuum.

In figuring manufacturing costs, wastage is calculated in pounds or feet or in percentage of the original material cost. But that's only half the story. In most cases it costs more to clean up waste than the material was originally worth. Furthermore, if not cleaned up frequently, waste slows up production and gets kicked around, creating dust which is spread all over the plant.

SPENCER VACUUM CLEANING in industry can reduce the cost of cleaning and practically eliminate the other profit consuming losses of this hydra-headed monster which may be eating up as much as 5% of the cost of your finished product.

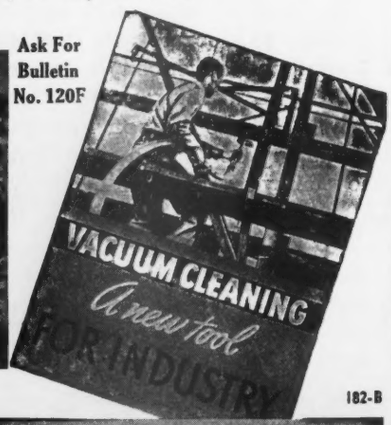
Spencer Vacuum is saving up to 25% of the time and cost of cleaning factory floors. It cleans walls, ceilings, pipes, and machinery with amazing rapidity and without distributing any dust.

It reduces fire, health and explosion hazards, reclaims valuable materials, reduces rejects, and cleans products during and after production. It saves in three or more of these ways in each plant according to a survey of 444 users, many of whom have enjoyed the benefits of a Spencer for a quarter of a century or more.

BUILT IN SIZES FOR ALL PURPOSES
Spencer Systems for industry vary in size from a ¾ HP portable to 100 HP stationary systems with inlet valves on each floor.

The new Spencer 7½ HP portable with a dirt capacity of 7½ cubic feet, for instance, may be just the thing to meet your requirements.

Ask For Bulletin No. 120F



182-B

SPENCER HARTFORD
CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS
THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

prepared to open a long-range training school for skilled workers. Branches were planned for the plants at Philadelphia, Baltimore, and East Springfield, Mass.

Soon afterward Westinghouse wages and salaries were adjusted upward 10 percent in conformance to the company's plan of keeping payment in tune with business volume and living costs.

Despite all these indications of increased activity, however, Westinghouse did not anticipate unprecedented prosperity. In fact, said Mr. Bucher:

"A large part of our month's business was taken at a very moderate profit since it represents emergency orders for the government's preparedness program."

•

Fake Army Inspectors Spotted in South

The inevitable outcropping of imposters is making its appearance in the wake of Uncle Sam's hugely augmented preparedness program.

Major Vere Painter, chief inspection officer of the Army Quartermaster Corps Depot at Philadelphia, reported receipt of several complaints from firms in Virginia which had been approached by unauthorized persons claiming to be QMC inspectors. Some of these men carried credentials, but the papers were faked.

"The Army Quartermaster Corps maintains a corps of inspectors, but our men all have proper credentials," said Major Painter.

•

Companies Formulate Policy On Conscripted Workers

Johnny will get his job back when he racks up his gun after his year of compulsory military training. That was understood from the start.

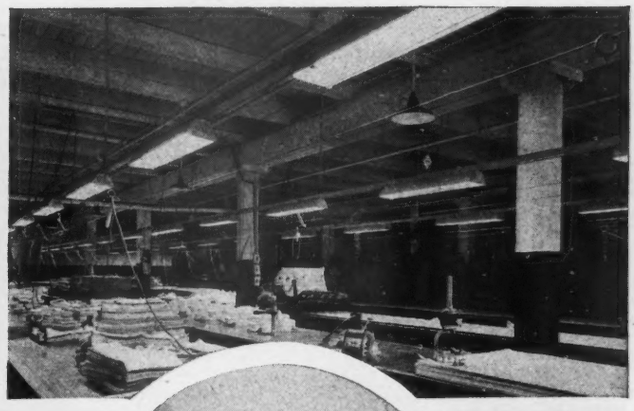
But it is significant to note the manner in which employers began to think and plan for Johnny's future as soon as the Burke-Wadsworth Bill took shape in Congress. This is revealed in a survey conducted by the American Management Association shortly before passage of the bill.

While the law was still being considered, many companies began surveys of their personnel to determine how conscription would affect them. Then they formulated a policy, as best they could, based on announced features of the law.

The AMA survey covered a large group of typical manufacturing concerns, as well as insurance companies, financial institutions, and utilities, and reflected policies affecting more than 300,000 hourly paid and salaried employees.

A cross-section of the survey indicates

NO ONE REFLECTOR CAN BE A *"Jack of all trades"*



But ALZAK

*REG. T. M., ALUMINUM COMPANY OF AMERICA

ALUMINUM REFLECTORS

are a versatile family

You must have a reflecting surface that puts the *kind* of light you want just where you want it. That means a diffuse reflector for one job, a specular surface for another, and various combinations of the two for many others.

With Alzak Aluminum Reflectors, you can get exactly what you need for highest lighting efficiency; the right reflecting surfaces and shapes.

High reflectivity is obtained in Alzak Aluminum Reflectors by a special electrolytic treatment of Aluminum sheet. The smooth, oxide surface of glass-like hardness will not chip, doesn't scratch easily and can be readily cleaned with soap and water. Long life and ease of maintenance make annual costs low.

We do not manufacture reflectors. Those companies who are licensed under Aluminum Company of America patents to produce Alzak Reflectors can advise you on the correct finishes to use for each application.

You can identify a genuine Alzak Reflector by a label affixed to it by the manufacturer. This lists the patents protecting the processes that assure uniform, high quality workmanship. Look for that label when you are buying reflectors.

ALUMINUM COMPANY OF AMERICA
1941 GULF BUILDING • PITTSBURGH, PA.

PLANT PARTITIONS at AMERICAN VISCOSE CORP. built with J-M TRANSITE WALLS

COMBINED WITH GLASS, Transite Walls form permanent, attractive partitions for American Viscose Corp., Textile Unit, Marcus Hook, Pa. Free-standing, ceiling-high, solid or glazed partitions are just as easily formed. And when partitions must be relocated, Transite Walls can be moved quickly, easily and economically.

Fireproof, sound-resistant, unusually durable, Transite Walls assure all the advantages of fixed walls plus the convenience and economy of movable partitions

FOR partitioning the Textile Unit at their Marcus Hook plant, American Viscose selected J-M Transite Walls. Here, as for scores of other leading manufacturers, these modern movable walls provide important savings on installation, maintenance and relocation that no plant operator can afford to overlook.

Made of asbestos and cement, Transite Walls are unusually resistant to sound-transmission . . . help keep offices quiet and private. Their uniform strength and durability provide years of low upkeep. Because they can't burn under any conditions, you're sure of complete fire-safety. And a simple, *dry* erection method, plus the large, light units in which Transite Walls are supplied, assure rapid, low-cost installation.

• • •

Whenever necessary, Transite Walls can be relocated quickly and easily with virtually 100% salvage of all materials. The dirt and inconvenience ordinarily associated with office rearrangement are eliminated. Transite Walls come in two types . . . Imperial and Universal. One or the other will meet your needs exactly.

For complete details on J-M Transite Walls, write for brochure TR-22A. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville

TRANSITE MOVABLE ASBESTOS WALLS

that the typical Johnny of military age will, when he returns from service, be reinstated at the same rate of pay with seniority rights intact and full credit for the year on any pension plan his company may maintain as well as protection under group insurance. Johnny's substitute, if one is hired, will be informed at the outset that his job is temporary. Johnny will not, however, be paid the difference between his Army pay and his salary during his absence except in a few rare instances.

A number of the companies inserted qualifications here and there bespeaking their fear of war or greatly unsettled business conditions.

All of which, as it turned out, voluntarily provided Johnny with about the same protection as the law, in its final form, guaranteed him.

•

NLRB Inquiry Goes On: Wierton Hits Ruling

Almost forgotten in the press of other events, the Smith Committee Congressional investigation of the National Labor Relations Board has been carried forward under the impetus of its determined counsel, Edmund M. Toland.

Toland has not been discouraged by the comparative obscurity into which the war has thrust his work. He still impales members and employees of the Labor Board and grills them intensively on their labor sympathies, their conduct of cases, and their political views in many of which he describes a decided "red tinge."

Meanwhile the Weirton Steel Company complained of excessive "bias and prejudice" in a demurrer to an NLRB ruling on a Weirton labor case.

•

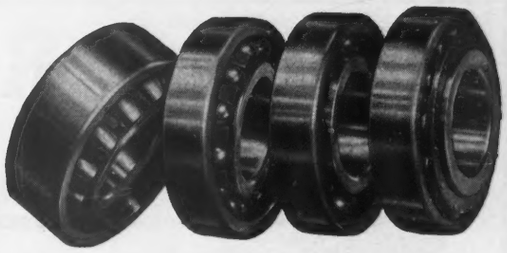
Packard Plans Increase In Car Production

The Packard Motor Car Company got one of the first big defense orders, but it will not rely on this for a big 1940. On the contrary it is going after the development of its peacetime markets with renewed vigor.

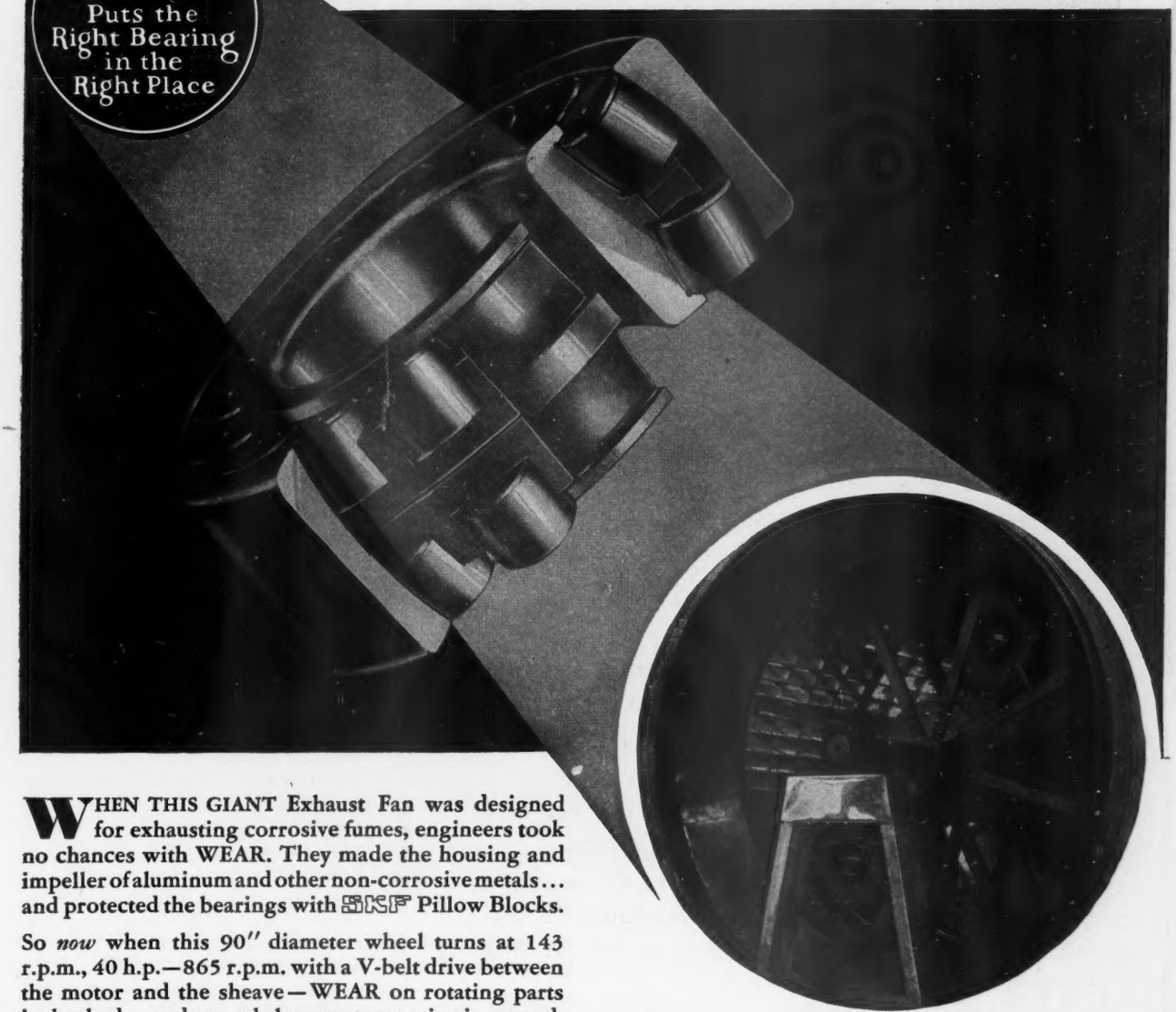
M. M. Gilman, president, has announced plans for the production of 110,000 Packard automobiles, against 95,000 for the current year. Drastic redesigning and the addition of much new luxury equipment are features of the new models, some of which will boast electrically operated windows and dividing partitions.

Meanwhile Packard is pushing plans to set up and operate an aircraft engine division to produce 3,000 Rolls-Royce Merlin liquid-cooled engines for the U. S. government and 6,000 for the

PROTECTED AGAINST WEAR ON VITAL PARTS BY SKF PILLOW BLOCKS



SKF
Puts the Right Bearing in the Right Place



WHEN THIS GIANT Exhaust Fan was designed for exhausting corrosive fumes, engineers took no chances with WEAR. They made the housing and impeller of aluminum and other non-corrosive metals... and protected the bearings with SKF Pillow Blocks.

So *now* when this 90" diameter wheel turns at 143 r.p.m., 40 h.p.—865 r.p.m. with a V-belt drive between the motor and the sheave—WEAR on rotating parts is checked... and smooth, low-cost operation is assured.

SKF Pillow Blocks are easy to assemble, inspect and lubricate. They occupy very little space . . . keep out dirt and moisture . . . keep in lubricant . . . are equipped with the exclusive SKF Triple Seal . . . assure plus-performance from the bearings inside them. You'll have a long way to go before you'll find another make of pillow block with all these advantages, so why not see your nearest SKF Distributor . . . TODAY?

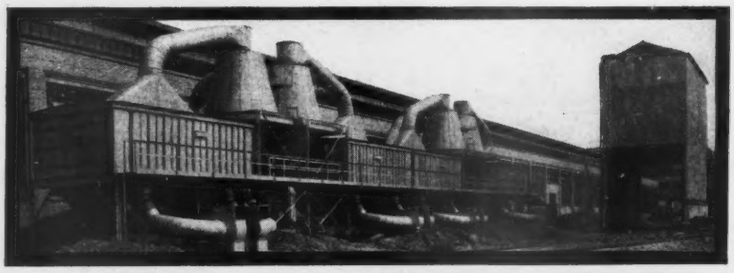
4661

SKF INDUSTRIES, INC., PHILADELPHIA, PA.

BUILT BY STERLING BLOWER CORP.

SKF
BALL & ROLLER BEARINGS

HUNDREDS
OF COMPANIES
—BIG AND LITTLE—



control the DUST HOG!

More than 4530 companies, realizing that the DUST HOG levies tribute in every way he can when he's let alone, are today controlling him the *economical* Pangborn way.

As a result, their workers are more efficient, freed from the obstruction and annoyance of needless dust.

Machinery runs more smoothly, is not worn out before its time in the grinding toils of dust.

Production schedules follow through, are not interrupted while dust-worn machinery is repaired.

Lighting is better, less expensive.

Plants are freed of the dangers of dust explosion.

Maintenance costs are cut down.

Machine and plant depreciation are lowered appreciably.

Valuable materials are salvaged instead of cast to the winds—a considerable item in many industries.

Products are not needlessly smudged or begrimed in course of manufacture.

Walls, supplies, windows, paintwork, are not made dingy, unsightly, to aggravate cleaning problems.

These, to mention a few, are some of the benefits of PANGBORN DUST CONTROL. You, too, can enjoy them by CONTROLLING DUST at its very source. Write to Pangborn today.

Send for Bulletin No. 903

PANGBORN

PANGBORN CORPORATION · HAGERSTOWN, MD.

British government at a cost of $187,000,000. This schedule will not interfere with automobile production and will utilize 800,000 square feet of existing floor space plus 500,000 square feet of new construction.

The aircraft job will put 14,000 men to work in addition to the 10,000 normally employed in building cars. The Rolls-Royce engines are similar to those that power the Spitfire and Hurricane combat planes of the Royal Air Force.

•

U. S. Firm Devises Tests For Color Blindness

New tests for color blindness prepared by American military authorities have made this nation independent of Germany and Japan, formerly the principal sources of color perception tests.

This was announced by the American Optical Company of Southbridge, Mass., which will distribute the new compilation. As approved for the use of U. S. armed forces, the new tests will replace as a national standard in this country the Ishihara test, printed in Japan, and the Stilling system, used in Germany, both of which are practically impossible to obtain in this country because of the war.

•

Aircraft and Ship Plants Lead Hiring Parade

Defense orders took hold first in the aircraft and shipbuilding industries and there, naturally enough, the first big increases in employment have been felt. The Labor Department's July study of labor turnover in the manufacturing industries found that the accession rate was 12.40 per 100 employees in aviation and 13 in shipbuilding.

In general the turnover rates remained about the same although a few lines allied with construction showed decided spurts.

"It is of particular interest that in a number of industries the quit rate exceeded the lay-off rate," the department reported, noting a significant turn of events. "In most industries this has not occurred since 1930. Even in the industries where it occurred this month, it is due to a low lay-off rate and not to a high quit rate. In the pre-depression years, an excess of quits over lay-offs customarily resulted from a high level of quits facilitated by a greater number of job opportunities."

There is a decided time lag in the compilation of the monthly turnover reports. But data of this sort, even though referring to July, are useful as a clue to the trends of later months.